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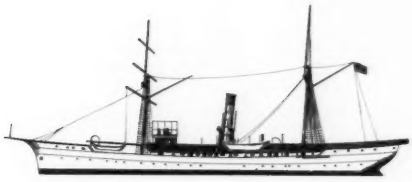

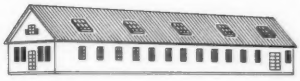

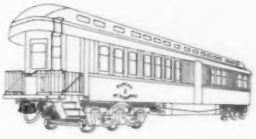

Spencer F. Baird
The First Commissioner
of U.S. Fisheries, and the Pioneer
and Architect of Federal Fisheries Research

THE NATIONAL MARINE FISHERIES SERVICE
125TH ANNIVERSARY

Marine Fisheries REVIEW

On the cover:
Spencer F. Baird surrounded by several of the major achievements in fisheries research and development attributed directly to his guidance as the Nation's first Commissioner of Fisheries.

The *Albatross*,
the world's first vessel
designed and built specifically
for marine research.

The Baird Hatchery,
the first Federal fish hatchery,
on California's McCloud
River.

"Old Main,"
the first Federal laboratory
for marine research, at Woods
Hole, Massachusetts.

The *Grampus*,
the very successful New
England schooner designed
as a prototype for safer
fishing vessels.

A "fish car,"
for transporting eggs
and fry across the nation by
railroad to stock lakes,
streams, and rivers.

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U.S. DEPARTMENT OF COMMERCE
Michael Kantor, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
D. James Baker, Under Secretary for Oceans and Atmosphere

National Marine Fisheries Service
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Charles H. Gilbert, Pioneer Ichthyologist and Fishery Biologist

J. RICHARD DUNN

Charles Henry Gilbert (Fig. 1) was a pioneer ichthyologist and, later, fishery biologist of particular significance to natural history of the western United States. Born in Rockford, Illinois on 5 December 1859, he spent his early years in Indianapolis, Indiana, where, in 1874, he came under the influence of his high school teacher, David Starr Jordan (1851–1931). Gilbert graduated from high school in 1875, and when Jordan became a professor of natural history at Butler University in Irvington, Indiana, Gilbert followed, and received his B.A. degree in 1879. Jordan moved to Indiana University, in Bloomington, in the fall of 1879, and Gilbert again followed, earning his M.S. degree in 1882 and his Ph.D. in 1883 in zoology. His doctorate was the first ever awarded by Indiana University.

Jordan and Gilbert, along with other students, explored the streams and rivers of Indiana and the southeastern United States in the late 1870's, describing a number of new fishes. In late 1879, Jordan was asked by Spencer Fullerton Baird (1823–1887), Commissioner of the U.S. Commission of Fish and Fisheries, to undertake a survey of the fisheries of the U.S. Pacific Coast. Jordan took a leave of absence from Indiana University, chose Gilbert as his assistant, and headed west to San Francisco in December 1879. They surveyed the area from southern California to British Columbia, and then Gilbert, alone, proceeded to Mexico and Panama to collect more fishes. Their 1-year pioneering survey of fishes in the west laid the foundation for nearly 50 years of study of Pacific fishes and fisheries by the team of Jordan and Gilbert.

By the time Gilbert received his Ph.D. degree at the age of 24, he was the author or coauthor of more than 80 scientific papers, all but three as junior author with Jordan. Gilbert served at Indiana University from 1880 to 1884, first as instructor, then as Assistant Professor in Natural Sciences and Modern Languages. In 1884, he accepted the Professorship of Natural History at the University of Cincinnati, remaining there until December 1888. In 1889, Gilbert returned to Indiana University as Professor of Natural History. During his tenure in Cincinnati, Gilbert also served as Naturalist-in-Charge of cruises of the U.S. Fish Commission Steamer *Albatross* in Alaskan waters in 1888 and off the U.S. west coast in 1889.

Jordan became president of Indiana University in 1885. However, in 1890, Senator and Mrs. Leland Stanford chose Jordan to be the founding president of a new university to be established in Palo Alto, California, in memory of their deceased son, Leland Stanford, Jr. Among Jordan's first appointments to the new faculty was the Chairman of the Zoology Department, Charles Henry Gilbert.

Gilbert then began a career at Stanford University which spanned nearly 37 years. He concentrated on Pacific fishes, mostly marine, and participated in expeditions ranging from Panama to Alaska, and served again as Chief Naturalist aboard the steamer *Albatross*, off Alaska in 1890, to the Hawaiian Islands in 1902, and to the Japanese Archipelago in 1906. As a pioneer descriptive ichthyologist, Gilbert described either alone or with others about 120 new genera and 620 species of fishes. He ranks with Jordan as the foremost ichthyologist of the American West.

Around 1909, Gilbert turned his attention to the study of Pacific salmon *Oncorhynchus* spp., and soon became the foremost expert on these economi-

Figure 1.—Charles Henry Gilbert, ca. 1903.

J. Richard Dunn, 521 Summit Avenue East, No. 202, Seattle, WA 98102, is a retired fishery biologist and a member of the Affiliate Faculty of the School of Fisheries, University of Washington, Box 355100, Seattle WA 98195-5100. This paper is condensed from the author's biographical work "Charles Henry Gilbert (1859–1928): Pioneer ichthyologist of the American west," in T. W. Pietsch and W. D. Anderson, Jr. (Editors), Collection building in ichthyology and herpetology. Am. Soc. Icthyol. Herpetol. Spec. Publ. 3 (in press).

cally important fishes. He studied salmon from California to Alaska, but concentrated his efforts in British Columbia (from about 1912 to 1921) and, from about 1918 to 1927, in Alaska. He was the first scientist to apply the scale method to aging of Pacific salmon, he pioneered racial studies using scales, and he was instrumental in establishing tagging programs on salmon in Alaska. Gilbert was also one of the very first scientists to consider the population dynamics of Pacific Northwest stocks of salmon. Altogether, he published over 170 scientific papers.

In his later years, Gilbert became an outspoken champion of the need for conservation of Pacific salmon resources, warning all who would listen that this resource was in dire jeopardy unless overfishing was curtailed. His world view was far ahead of his time, and he urged the U.S. Bureau of Fisheries, successor to the U.S. Commission of Fish and Fisheries, to instigate data collection programs on Alaska salmon and to regulate the commercial salmon fisheries.

Always formal and proper and a man of seemingly high "moral" standards, Gilbert nevertheless was a demanding person with a sharp eye and an even sharper temper. He was an active teacher, administrator, and researcher at Stanford University. He supervised the graduate studies of several notable ichthyologists and fisheries biologists, among them William Francis Thompson (1888–1965) and Carl Levitt Hubbs (1894–1979).

Gilbert retired in 1925, but continued his research as an Emeritus Professor. He died on 20 April 1928 at the age of 68. His wife, Julia, born in 1849, died in 1916. There were three children, Carl (1891–1963), Winnifred (Mrs. Carl F. Braun, 1886–1980), and Ruth (Mrs. Percy R. Baker, 1885–1982), all of whom were graduated from Stanford University.

Gilbert has been remembered and honored by ichthyologists and fishery biologists for his many contributions. In his honor, the Gilbert Fisheries Society was established in 1931 in the College of Fisheries, University of Washington, Seattle. This organization was short lived, however, and the Society was reconstituted in 1989 in Seattle as the Gilbert Ichthyological Society. A U.S. Bureau of Commercial Fisheries research vessel was commissioned in 1960 as the *Charles H. Gilbert,* and, recently, a new building at Stanford University was named the Charles H. Gilbert Biological Sciences Building.

Charles Henry Gilbert (1859–1928), Naturalist-in-Charge, and Chauncey Thomas, Jr. (1850–1919), Commanding: Conflict Aboard the U. S. Fish Commission Steamer *Albatross* in 1902

J. RICHARD DUNN

Introduction

The name Charles Henry Gilbert (1859–1928) is an important one in the annals of ichthyology and fisheries biology of the American West. A student of David Starr Jordan[1] at Indiana University during the 1880's, Gilbert (Fig. 1) received his doctorate in zoology in 1883, the first such degree ever awarded at that institution. When Jordan was selected in 1891 to be the founding president of the newly established Leland Stanford Junior University in Palo Alto, California, Gilbert was chosen by Jordan to head the Zoology Department. During his tenure at Stanford (1891–1925), Gilbert was a diligent student of fishes of western North America. As a temporary employee of the U.S. Commission of Fish and Fisheries (hereafter referred to as the Fish Commission) at various times, he participated in several expeditions aboard the Commission's Steamer *Albatross* (Hedgpeth, 1945; Dunn, In press; Gilbert[2]).

Gilbert was compulsively dedicated to his work (Dunn, In press; Pietsch and Dunn, In press). He also possessed a strong, demanding personality. As Walter Kenrick Fisher (1940), a former student of Gilbert, wrote:

"Professor Gilbert was a scientist of very unusual talents, with a controlled and keen, logical mind. He exercised no patience with loose thinking or any work short of the best which a student could produce. His seminars afforded adequate outlet for his uncanny powers of searching analysis and relevant criticism. His students more than once have heard him relentlessly demolish a thesis of one of the Elect . . . ."

An example of Gilbert's dedication to his profession, as well as his intense personality, is his scientific leadership of the 1902 cruise of the *Albatross*, in waters around Hawaii. During this expedition, Gilbert and the captain of the vessel, Lt. Commander Chauncey Thomas, Jr. (1850–1919), U.S.N. (Fig. 2), engaged in an acrimonious feud over what Gilbert perceived to be a lack of dedication by the captain.[3]

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ABSTRACT—Charles Henry Gilbert (1859–1928) was a pioneering ichthyologist who made major contributions to the study of fishes of the American West. As chairman of the Department of Zoology at Leland Stanford Junior University in Palo Alto, Calif., during 1891–1925, Gilbert was extremely devoted to his work and showed little patience with those of a different mindset. While serving as Naturalist-in-Charge of the U.S. Fish Commission Steamer Albatross *during her exploratory expedition to the Hawaiian Islands in 1902, Gilbert engaged in an acrimonious feud with the ship's captain, Chauncey Thomas, Jr. (1850–1919), U.S.N., over what Gilbert perceived to be an inadequate effort by the captain. This essay focuses on the conflict between two strong figures, each operating from different world views, and each vying for authority. Despite the difficulties these two men faced, the voyage of the* Albatross *in 1902 must be considered a success, as reflected by the extensive biological samples collected, the many new species of animals discovered, and the resulting publication of important scientific papers.*

[1]Jordan (1851–1931) was the preeminent ichthyologist of North America during the late 19th and early 20th centuries (Myers, 1951; Hubbs, 1964). President of Indiana University from 1885 to 1891 and founding President of Leland Stanford Junior University in 1891, his autobiography (Jordan, 1922) contains a wealth of information about ichthyology and fisheries biology as well as personalities of the era.

[2]Correspondence of Gilbert. National Archives (NA), Record Group (RG) 22, Entry (E) 63, Records of the *Albatross*,

[3]Thomas was graduated third in his class from the U.S. Naval Academy in 1871. He commanded many naval vessels and served at various stations during his naval career, rising to Commander-in-Chief U.S. Pacific Fleet in 1911. He retired in 1912, holding the rank of Rear Admiral (Hamersly, 1902; Anonymous, 1943).

Figure 1.—Charles Henry Gilbert (ca. 1903), courtesy of Linda Long and the Stanford University Archives.

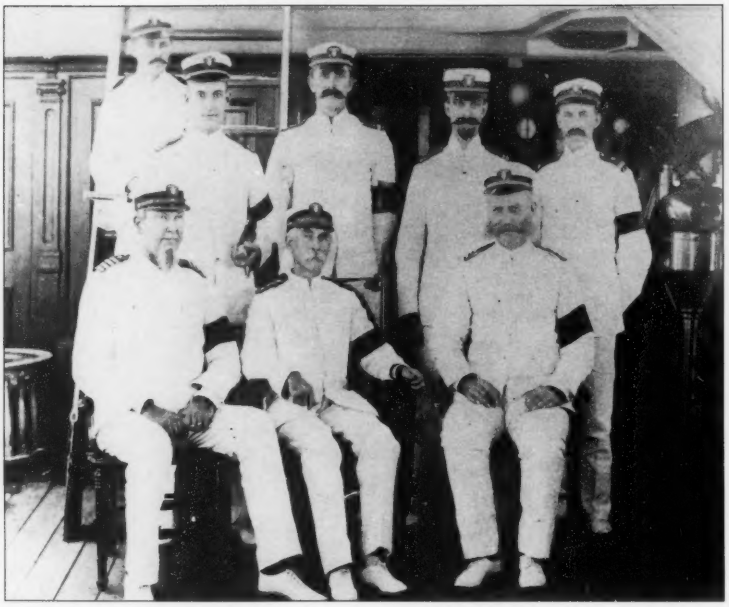

Figure 2.—LCDR Chauncey Thomas, Jr., front row, right, aboard the U.S.S. *Baltimore* in 1899 (NH 54428). Courtesy of the U.S. Naval Historical Center, Washington, D.C.

The two antagonists were each operating from different world viewpoints. Gilbert, the scientist, academician, and authority on fishes, was not accustomed to having his viewpoints challenged (Dunn, In press). Commander Thomas, a U.S. Naval Academy graduate and career officer, likewise was comfortable with authority, and did not suffer lightly questions of his command. This paper describes the 1902 Hawaiian expedition of the *Albatross*, which, despite the problems of the two antagonists, was a remarkably successful voyage, resulting in the discovery of many species new to science as well as many scientific publications of relevance even today.

Much of the U.S. Fish Commission's marine research at the turn of the century was exploratory in nature, with goals of determining what resources were located where. For example, from 1887 to 1902, the *Albatross* conducted surveys off South America, off the North American West Coast from Mexico to Canada and in Alaskan waters, in the South Seas, and off Japan, among other excursions (Hedgpeth, 1945). The expedition to the Hawaiian Islands in 1902 (Anonymous, 1902a) was directed toward assessing fishery resources, and it followed an on-shore survey of fishes in 1901 conducted by Jordan and Barton Warren Evermann[4] (Jordan and Evermann, 1902; 1903a, b) and sponsored by the Fish Commission (Smith, 1904).

According to the Fish Commission (Bowers, 1904), the purpose of the *Albatross* expedition to Hawaii in 1902 was as follows:

"In continuation of the investigation of the Hawaiian fisheries, begun in 1901 by direction of Congress, it was decided to send the *Albatross* to those islands to study the conditions in the surrounding waters. An arrangement was made with Dr. David Starr Jordan to have general supervision of the expedition, and Dr. Charles H. Gilbert was put in immediate charge of the scientific work. The investigation was to embrace dredging and collecting in channels and on the banks about the islands, and a thorough examination of the surroundings of Kauai, the oldest of the group, of outlying reefs about the islands northwest of Kauai, and of the different fishing-banks. It is believed information of both commercial and scientific importance will be gained . . . ."

The Hawaiian Islands had been annexed by the United States in 1898 and were made a colonial territory in 1900 (Abell et al., 1955). Hence the Government's interest in the fishery resources of this newly acquired region.

Primary source material for this narrative are Gilbert's letters to Jordan[5] and to Thomas,[6] as well as the progress reports submitted by Thomas to the Fish Commission.[7] Dredging and other records of the *Albatross* for 1902 are listed in Report of the U.S. Commissoner of Fish and Fisheries (USFC, 1904).

The *Albatross* Expedition of 1902 to the Hawaiian Islands

The Steamer *Albatross* (Fig. 3), commissioned in 1882, was a iron-hulled, twin-screw vessel of 234 feet (70 m) in length, displacing 1,074 tons, with a total sail area of 7,521 square feet. She was reputedly the first vessel in the world built especially for marine fisheries and oceanographic research and was operated by the U.S. Navy for the Fish Commission, later (1903) named the Bureau of Fisheries (Hedgpeth, 1945; Mooney, 1991). The *Albatross* had a distinguished career serving national and international fisheries interests for nearly 40 years (Townsend, 1924; Hedgpeth, 1945; Peterson, 1988). Her service and contribution to Pacific fisheries was especially notable (Dunbar and Friday, 1994).

Gilbert was appointed "Naturalist-in-Charge" of the vessel, a temporary po-

[4]Evermann (1853–1932), also a student of Jordan, was Assistant-in-Charge, Division of Statistics and Methods of the Fisheries of the U.S. Fish Commission (USFC, 1905). He was with the Fish Commission from 1888–1914, and was later Director of the California Academy of Sciences, in San Francisco (Palmer, 1933; Hanna and Peers, 1944).

[5]Charles Henry Gilbert Papers (CHGP), Stanford University Archives (SUA), Stanford, CA, SC 58.

[6]Correspondence of Gilbert. NA, RG 22, E 63. See footnote 2.

[7]Reports for the Steamer *Albatross* for 24 March–3 August 1902; NA, RG 22, Folder *Albatross*, Box 6, 150/1/19/4.

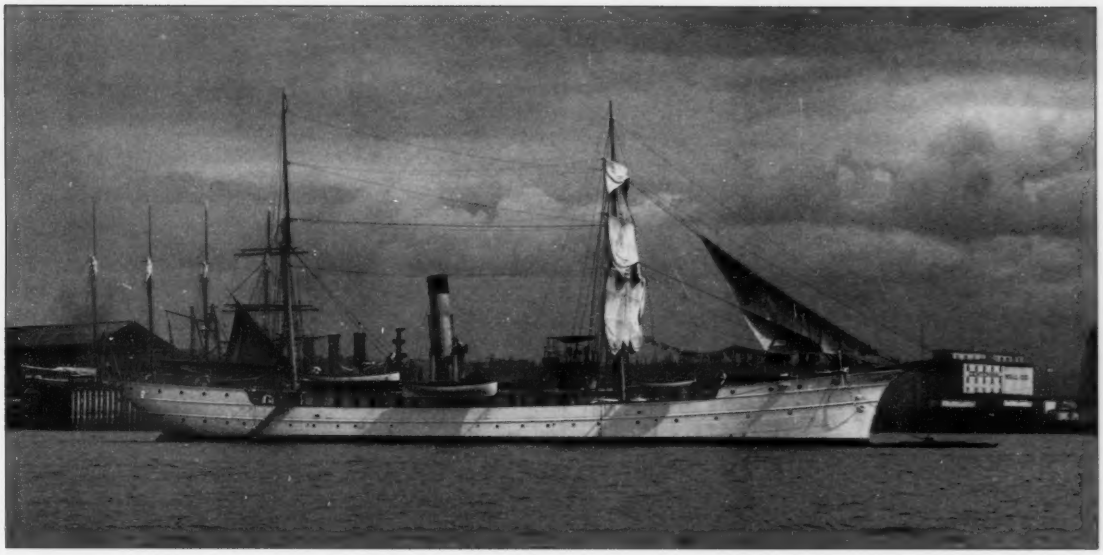

Figure 3.—U.S. Fish Commission Steamer *Albatross* (no. 2824–1). Courtesy of Puget Sound Maritime Historical Society and Museum of History and Industry, Seattle, Wash.

sition which he occupied while on leave from Stanford University.[8] He was assisted by Charles Cleveland Nutting,[9] of the University of Iowa, John Otterbein Snyder,[10] of Stanford University, and Walter Kenrick Fisher,[11] then a graduate student of Gilbert at Stanford.[12] Fishery expert Alvin Burton Alexander and resident naturalist Frederic Morton Chamberlain were on the permanent staff of the vessel (USFC, 1905).[13]

Beam trawls and dredges were the vessel's principal sampling gears, but dip nets, gill nets, surface tow nets, and mid-water nets were also used. Shore and reef collecting was conducted at various points. Collections of both vertebrates and invertebrates were preserved for later study. Hydrographic and meteorological observations were recorded (USFC, 1904).

Captain Thomas had reservations about the extent of his authority even before the *Albatross* sailed from San Francisco. He wrote the Commissioner of Fisheries on 10 March 1902, prior to the ship's departure from San Francisco, as follows:

"An incident occurred recently which caused me to critically re-examine the Commission's instructions of October 29th, 1901, concerning the cruise in Hawaiian waters about to begin, and I wish to invite your attention to the wording of paragraph 3 of that communication, in which it is stated that Dr. Gilbert will have sole charge of the scientific work of the expedition, and the movements of the vessel *will be subject to his direction* [sic]."[14]

Thomas protested this provision, arguing that the captain "always held the final decision of all questions arising on a cruise," and he argued that the captain's authority must be restored. Thomas, with prescient foresight, argued:

"I have no desire to quibble or to cause any ill feeling and I shall at all times consult Dr. Gilbert as to his wishes and conform to them in all ways practicable, but there may easily arise differences of opinion as to the scope of the authority of the head of the scientific expedition and the commanding officer and in that case I have only the concluding portion of the same paragraph to support the authority of the Commission, and that really refers simply to the supply of boats and men."[14]

[8]Aboard the *Albatross*, chief naturalists or "Naturalists-in-Charge," were temporary appointments created for visiting scientists and researchers. They were contrasted to "resident naturalist" which was a permanent Fish Commission position for the ship. This practice apparently dates from the first Commissioner of the U.S. Commission of Fish and Fisheries, Spencer Fullerton Baird (1823–1887), who frequently relied on academic scientists for research (Mark R. Jennings, Natl. Biol. Surv., Davis, Calif., personal commun., 2 June 1996). For more on the early history of the Fish Commission, see Cart, 1968; Allard, 1978; and Hobart, 1995.

[9]Nutting (1858–1927) was a Professor of Zoology at the State University of Iowa and was a specialist in invertebrate zoology (Cattell and Brimhall, 1921).

[10]Snyder (1867–1943) was a Professor of Zoology at Stanford University, whose specialty was fishes (Hubbs, 1943).

[11]Fisher (1878–1953), a Professor of Zoology at Stanford University from 1905 to 1943, specialized in invertebrate zoology (Davis, 1958).

[12]Anonymous (1902a). This article succinctly described the expedition plans and participants.

[13]Alexander had served on the *Albatross* since 1888 (Hedgpeth, 1945). For more on Chamberlain (1867–1921), see Jennings (1987).

[14]Thomas to Commissioner of Fisheries, dated San Francisco 10 March 1902. NA, RG 22, E 63, See footnote 2.

Thomas closed his letter with a plea to modify the sailing orders "as to leave final decisions in the hands of the commanding officer after consultation with Dr. Gilbert."[14]

Thomas's letter was answered by the Commissioner on 17 March 1902, although it was not received by the captain until he arrived in Honolulu. Commissioner George Montague Bowers[15] wrote that "through inadvertence the direction of the movements of the 'Albatross' on the present cruise is virtually taken out of the hands of the commanding officer." Commissioner Bowers therefore changed the orders to read, in part:

". . . . You will so arrange the movements of the vessel as to accomplish to the best advantage the objects desired, and to this end it is expected that you will confer with Dr. Gilbert. But as commanding officer and the immediate representative of this Commission, and in view of your responsibility thereto and to the Navy Department, it is expected that your decision in an emergency will be final."[16]

The *Albatross* departed San Francisco on 11 March 1902 for the Hawaiian Islands. The trip to Honolulu was not without difficulties and presented an ominous beginning of the expedition. Heavy weather was encountered on the first day's outing, and on 12 March the ship's quartermaster was thrown off the vessel and lost at sea.[17]

Attempts to trawl on Erben Bank enroute to Hawaii were made on 15 and 16 March, but they were a failure and, according to the captain, "the beam trawl, a boat trawl with tangles, the tangles and tangle bars, utilized at different time being all lost and the strains put on the dredging cable are said never to have been exceeded in the ship's history."[18]

A total of 18 stations were sampled, using surface and intermediate-water nets, enroute to and in the vicinity of the Islands before the vessel arrived in Honolulu on 24 March (Table 1; Fig. 4, 5). The ship remained in port for coaling and maintenance until 27 March.[18]

Gilbert wrote Jordan a progress report on 23 March, while the vessel was within a day's sail of Honolulu. He described the dredging attempts made on the way to Hawaiian waters:

"At about 9 o'clock each morning, and at 8 o'clock at night, we have hauled one net at the surface, and have sent another one down to a depth of 50 to 150 fathoms. An astonishing amount and variety of life has been shown to exist. We have Protozoa, Coelenterates, Mollusks, Crustacea, Insects, and fishes—not to mention diatoms among the plants. The work has been done systematically, and the material carefully sorted and preserved. The field seems to be inexhaustible, as many new forms appear with each haul. The most remarkable animal came up from 100 fathoms. It is an elongate to worm-like creature, which we pronounced on casual inspection to be a Crustacean, and then later a worm. Its eyes are on flexible stalks half an inch long. Fisher and Snyder began to draw and study it, and began to insist that it was a vertebrate. It is undoubtedly *a bony fish*, tho' possibly a larval form. The tail is heterocercal, the dorsal and anal developed, and the pectoralis peculiar broad flaps without very definite rays. If it is a larval form, I have no faintest idea what the adult will turn out to be."[19, 20]

Gilbert continued his letter, describing other interesting specimens they had collected, and he was, in particular, most fascinated with the larvae and young of fishes they were encountering. He wrote:

"If the young of local fishes can be taken almost anywhere in the open sea, it might be possible to map out zones of influence belonging to definite faunas, and to determine also the causes which limited their occurrence in certain waters."[21]

Gilbert proposed to Jordan that upon completion of the Hawaiian Island expedition, such an attempt to inventory larval and juvenile fishes be conducted. He suggested that a line be run due east from Hawaii to the California coast to sample these forms systematically.[22]

At this early stage in the expedition, Gilbert had nothing but praise for the conduct of the ship. He wrote Jordan:

"Our organization seems to be excellent. Captain Thomas is excellently disposed, with very genuine appreciation of the work we are trying to do."[22]

During the first part of the cruise, the *Albatross* was trawling during the day and anchoring at night. This schedule was due, in part, to the shortage of a crew member because of the loss of the

[15]Bowers was Commissioner of Fisheries from 1898 to 1913 (Cart, 1968).

[16]Bowers to Thomas, dated Washington, D.C., 17 March 1902. NA, RG 22, E 63, No. 6447. See footnote 2.

[17]Thomas reported to the Commissioner: "The *Albatross* sailed from San Francisco, as reported by telegraph, at 2:05 p.m. of the 11th instant. Outside the heads she encountered heavy weather with a long swell from NW, wind fresh from the same direction. It was necessary to run the ship off four point from her course in order to avoid damage to the upper works from seas coming on board. At 2 a.m., of the 12th, in latitude 36 25' N., longitude 123 44' W., while taking the reading of the patent log and on duty as quartermaster of the watch, Bert Arnkil, Quartermaster, 3rd class, U.S. Navy, fell overboard or was flung over the rail by a violent lurch of the ship in the rough sea prevailing. Every effort was made to recover the unfortunate man but without avail. The lack of self lighting life buoys would have prevented

[17 (continued)] a return to the spot with accuracy but the ship was put about and remained near the scene of the accident till after daylight with the hope of recovering the body but no signs of it were seen. A brother of the deceased is serving on board this ship and his wishes were taken regarding the effects of the drowned man. The requirements of the U.S. Navy Regulations in such cases have been carried out." Letter No. 83, Thomas to the Commissioner, dated Honolulu 24 March 1902, NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[18]Thomas to the Commissioner, letter No. 83, dated Honolulu 24 March 1902, NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[19]Gilbert to Jordan, dated *Albatross* 23 March 1902. CHGP, SUA, SC 58.

[20]The larval fish with the elongate, stalked eyes, may have been a species of *Idiacanthus* (see Kawaguchi and Moser, 1984).

[21]Gilbert to Jordan dated, *Albatross* 23 March 1902. CHGP, SUA, SC 58.

[22]Gilbert to Jordan, dated *Albatross* 23 March 1902. CHGP, SUA, SC 58. The proposed larval fish survey was not conducted.

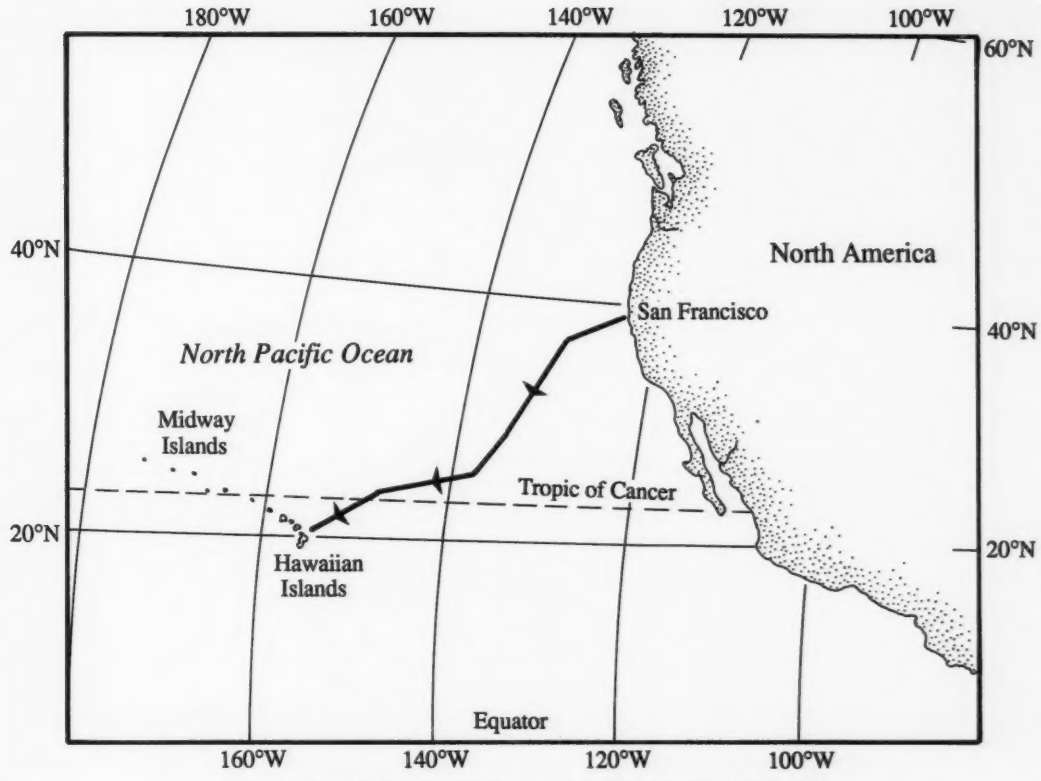

Figure 4.—Approximate route of the *Albatross* to the Hawaiian Islands, March 1902.

Table 1.—Route of the Steamer *Albatross* and number of stations sampled in the Hawaiian Archipelago, March-August 1902 (USFC, 1904).

Date	Route	No. of stations occupied
11–16 Mar.	San Francisco to Kauai Channel, Hawaiian Islands	5[1]
17–23 Mar.	Kaiwi Channel, Hawaiian Islands	13[2]
27–31 Mar.	South coast of Oahu .	10[3]
31 Mar.–9 Apr.	South coast of Molokai.	37[4]
9–11 Apr.	Between Molokai and Maui Islands	14[5]
11–14 Apr.	Between Maui and Lanai Islands	8[6]
14–15 Apr.	South of Lanai Island.	3[7]
16–17 Apr.	Between Maui and Molokai Islands	6
17–18 Apr.	North coast of Molokai	6[2]
19 Apr.	Between Molokai and Oahu Islands	2[8]
28 Apr.	South of Molokai Island	1[7]
29 Apr.	Between Maui and Lanai Islands	1
29 Apr.	Between Maui and Molokai Islands	5
30 Apr.–1 May	North coast of Molokai Island	5[9]
5–7 May	South coast of Oahu Island	19[10]
10–15 May	Honolulu to Laysan Island	6
16–23 May	Vicinity Laysan Island	36[11]
29 May	French Frigate Shoal	7[12]
31 May	Necker Island Shoal to Bird Island	2
2–3 June	Vicinity of Bird Island	3
9 June	Between Honolulu and Kauai Islands	1
10–17 June	Vicinity of Kauai Island	25[13]
17 June	Between Honolulu and Kauai Islands	3[13]
17–18 June	Between Kauai and Oahu Islands	3
20–24 June	Vicinity of Kauai Island	19[14]
9 July	South coast of Oahu Island	5
10–14 July	West coast of Hawaii Island	17[15]
16–18 July	Northeast coast of Hawaii Island	12[8]
18 July	Between Hawaii and Maui Islands	2[2]
19–21 July	North coast of Maui Island	20[8]
21–22 July	Between Maui and Molokai Islands	11[8]
23 July	North coast of Maui Island	2[2]
23 July	Between Maui and Molokai Islands	5
24 July	Between Molokai and Oahu Islands	9
25 July	Northwest coast of Oahu Island	8[8]
26 July	Southwest coast of Oahu Island	3[8]
31 July	Between Oahu and Kauai Islands	2[7]
31 Jul.–2 Aug.	Vicinity of Kauai Island	18[16]
4 Aug.	Between Kauai Island and Bird Island	1
5–8 Aug.	Vicinity of Bird Island	28[17]
11–12 Aug.	Vicinity of Nihau Island	7[18]
13 Aug.	Vicinity of Kauai Island	7[2]
23–27 Aug.	Between Honolulu and San Francisco	3

[1] Lost two dredges and one tangle net.
[2] Net damaged during one haul.
[3] Net damaged on one haul; complete Tanner net lost on another haul.
[4] Net damaged on five hauls; complete Tanner net lost on one haul.
[5] Damage to gear on three occasions; dredge lost on one haul.
[6] Lost tangle gear at one station.
[7] Lost Blake frame and net at one station.
[8] Gear damage at two stations.
[9] Lost complete Tanner net at one station.
[10] Lost complete trawl on three occasions; extensive net damage on another haul.
[11] Lost complete trawl on four occasions; net damage at six stations.
[12] Damage to gear on three stations.
[13] Extensive damage to gear at ten stations; trawl lost at one station.
[14] Gear damage at six stations; gear lost on one haul.
[15] Trawl damage at three stations; trawl lost at two stations.
[16] Net damage at six stations; gear lost on two stations.
[17] Gear damage at seven stations; trawl lost at one station.
[18] Net damage at one station; gear lost at another.

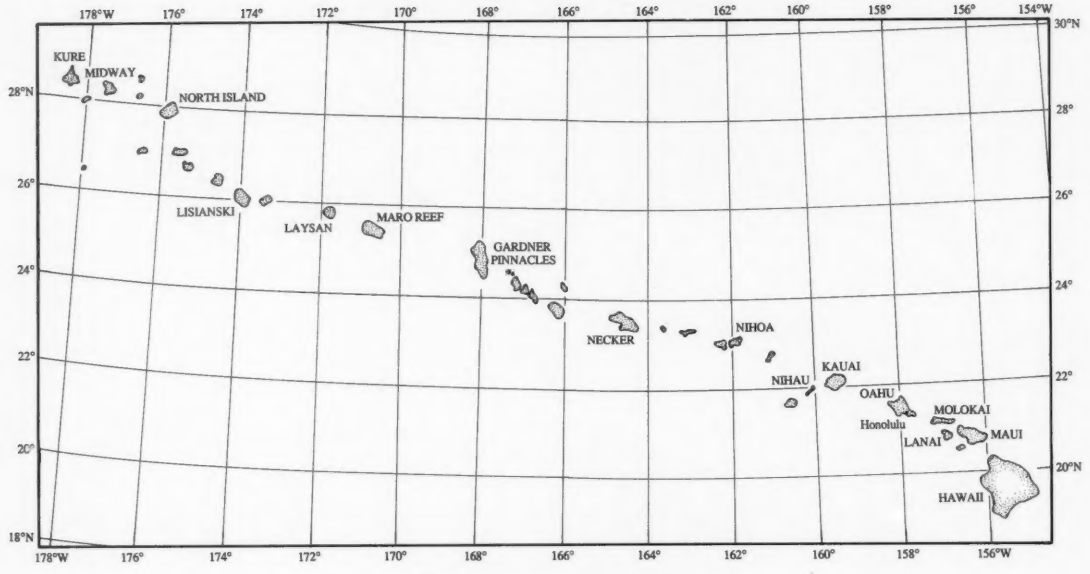

Figure 5.—Hawaiian Archipelago.

ship's quartermaster.[23] According to the captain's orders of 27 March: "When the ship is within reasonable distance of suitable ports she will be anchored therein and liberty granted the crew on Saturday afternoons and Sundays as required by U.S. Navy Regulations...."[24]

From 27 March to 19 April, the *Albatross* dredged off the coasts of Oahu, Molokai, Maui, and Lanai islands (Table 1). Loss or damage to sampling gear was a significant problem during this period. Damage to nets was recorded on 14 hauls, and the gear was lost on five occasions (Table 1). Such extensive loss or damage to sampling gear caused considerable apprehension to the captain. Materials for repairing nets were ordered from San Francisco and a report was written to the Commissioner about the extensive gear loss.[25]

The ship returned to Honolulu on 19 April for repairs and maintenance. By this time, Gilbert was becoming dissatisfied with the pace of work. He wrote Jordan on 27 April 1902:

"We have been resting on our oars for the last week, "making necessary repairs to the boilers and engines." I have been deeply disappointed with the amount of work we are able to get out of the ship. Sixteen days is the record during April, not excessive activity, surely. I have gently prodded and plead, but to no effect, except to exasperate. Unless your worthy Captain can divorce himself further from mail stations, and can strike a better pace, we shall fall far short of the completion of our task."[26]

Gilbert described to Jordan the problems they were having with lost and damaged gear. Despite these conditions, the hauls were most interesting and rewarding scientifically. Jordan responded to Gilbert by letter in late May. He wrote:

"I am very sorry indeed to hear that matters are not satisfactory. Your captain has the opportunity of his life, but he does not seem to realize the existence of the great world outside naval affairs. I will write the Commissioner in regard to the matter and see what can be done."[27]

In late April and early May, the vessel dredged off the north coast of Molokai Island (Table 1). The ship then returned to the vicinity of Oahu Island for further work, before returning to Honolulu. Again, gear loss and damage continued. As Thomas recorded:

"During the dredging operations of these three days [5–7 May], two 11 foot

[23]Thomas to the Commissioner, letter no. 83, dated Honolulu 24 March 1902, NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[24]Order from Chauncey Thomas, Commanding, dated 27 March 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[25]Thomas to the Commissioner, letter no. 98, dated Honolulu 19 April 1902, NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[26]Gilbert to Jordan, dated Honolulu 27 April 1902. CHGP, SUA, SC 58.

[27]Jordan to Gilbert, dated Stanford 24 May 1902. CHGP, SUA, SC 58.

Tanner and an 8 foot Blake trawl frames, one dredging sinker, 80 fathoms of cable, and a complete tangle with 8 swabs, as well as tail weights, floats, etc., have been lost by encountering coral or lava rock bottom. The catch, however, exceeded expectations and Dr. Gilbert described Tuesday's work as the most satisfactory of the cruise."[28]

The *Albatross* on 10 May then proceeded west to Laysan Island and vicinity. This leg of the cruise lasted until 5 June (Table 1). In addition to dredging, shore excursions for scientific sampling were made on Laysan, Necker, and Bird islands.[29]

After a hiatus in Honolulu from 5 to 9 June, the ship proceeded to the vicinity of Kauai Island for further sampling (Table 1). Again, damage to gear was extensive. The *Albatross* returned to Honolulu on 18 June and Gilbert and Thomas met with Jordan for a review of the progress of the expedition.[30] Jordan had arrived from Stanford and was enroute to Pago Pago, Samoa.[31] An additional period of sampling near Kauai Island followed from 20 to 24 June, before the ship returned to Honolulu for maintenance and repairs.

By then, the relationship between Thomas and Gilbert had steadily deteriorated. On 25 June, Gilbert wrote Jordan listing unfinished work. Included was work planned, but not yet completed, near all the major islands of the Hawaiian Archipelago, as well as Bird Island. Gilbert gave a copy of the letter to Thomas.[32]

Thomas replied to Gilbert by memorandum on 30 June. In it, he reviewed his discussions with Jordan. Thomas concluded his message to Gilbert by writing:

"A copy of my communication (letter #117) to the Commission embodying my understanding of the wishes of Dr. Jordan is transmitted herewith for your information. I desire to complete the work in hand by the arrival of Dr. Jordan returning from Samoa and do not wish to undertake any additions to his expressed desires that will delay the completion of the same at that time."[33]

Thomas then wrote the Commissioner on 30 June concerning Gilbert's list of unfinished work. He explained:

"Comparing my understanding of Dr. Jordan's ideas with those advanced by Dr. Gilbert, the large additional work desired by the latter will be at once apparent. I was under the impression that the trying work incident to the cruise in these tropical waters could be completed by hard work at the time of the return of Dr. Jordan on August 18th, but if the ideas advanced in this later communication are to prevail, no limit can be set to detention that will result . . . ."[34]

Thomas concluded this message with a plea that the Commission set a termination date for the expedition. Further, that no additions to the schedule be allowed.

In a long, plaintive, and angry letter to Irving Hall Dunlap, chief clerk of the Commissioner's Office, dated 2 July, Thomas wrote:

"I am between the devil and the deep blue sea, i.e., Dr. Gilbert and Dr. Jordan. The latter formulated certain work while here, a full report of which was embodied in an official report to the Commission recently. Now comes Dr. Gilbert and largely increases Dr. Jordan's requirements in a communication to that gentleman, a copy of which has been furnished me. By working nights and Sundays I can just about complete Dr. Jordan's desires by the date of his return, August 18th, but to accomplish Dr. Gilbert's additions will consume, the good Lord knows how much longer. I am sending a copy of the latter communication for the information of the Commission and a comparison will show the additions.

"Dr. Jordan told me that if on his return Dr. Gilbert was satisfied, he would also be satisfied. Now I defy the Angel Gabriel to satisfy Dr. Gilbert in the matter of dredging and I see no prospect of the ship's being relieved from service in this tropical clime till snow blows over the Washington Monument. I want to do my whole duty and I want to do it cheerfully but I feel that we are being imposed upon by these Stanford people who do not care for anything connected with the Fish Commission but are all for their institution and really we have worked harder than the records show of similar work for any period of her service.

"I am bound hand and foot to Dr. Jordan's desires, expressed by Dr. Gilbert's wishes. I can get along with the former but the latter needs a strong hand to manage him. So I am going to appeal once more for some show of relief from this climate before the same kills us all off. I have sent the Commission officially a full statement of this matter and I should be glad of a favorable decision. Burrage[35] has had a long talk with him on the subject of future work in the light of his memorandum for Dr. Jordan and my letter #117, a

[28]Thomas to the Commissioner, letter no. 105, dated Honolulu 8 May 1902, NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[29]Thomas to the Commissioner, letter no. 109, dated Honolulu 5 June 1902, NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[30]Jordan to Hugh M. Smith, dated Stanford 5 June 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4. Jordan wrote to Smith, who was Acting Commissioner of Fish and Fisheries, that "The work about the Hawaiian Islands has gone on more slowly than I anticipated...." Jordan requested that the vessel return by the way of the Revillagigedo Islands and described the reasons for this proposed work.

[31]Jordan sailed to Hawaii from San Francisco in June 1902 on a combination business and pleasure trip. His wife was in ill health and was in Honolulu recuperating. Jordan came to visit her, arriving in Honolulu on 18 June, and then continued to Samoa to collect fishes. This latter expedition was also supported by the Fish Commission (Anonymous, 1902b). Jordan met with both Gilbert and Thomas while in Honolulu. Jordan to Gilbert, dated 12 May, 24 May, and 11 June 1902. CHGP, SUA, SC 58.

[32]Gilbert to Jordan, dated Honolulu 25 June 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[33]Thomas to Gilbert, dated Honolulu 30 June 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[34]Thomas to the Commissioner, dated Honolulu 30 June 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[35]Guy Hamilton Burrage was the ship's engineering officer on this cruise. He subsequently served as captain of the *Albatross* from 1910–1912 (Hedgpeth, 1945).

copy of which I have given him. He became so offensive in his remarks that Burrage had to tell him that he was forgetting himself. He will not tolerate any superior authority to himself and his desires and even the plainly expressed desires of Dr. Jordan have no effect on him in the way of subordination. He said that he doubted if he could complete the work assigned by Dr. Jordan prior to his return and then warned us that unless he, Gilbert, was satisfied Dr. Jordan would not be. Now the Angel Gabriel could not satisfy Dr. Gilbert. He is insatiable. Dr. Jordan pointed out the places in which he desired dredging to be done but that cuts no ice with Gilbert. He plainly asked if he could not dredge where he wanted and when told that Dr. Jordan's wishes would be solely followed, flew into a rage. I shall draw the line closely to what Dr. Jordan told me and I wish to have the Commission back me up in the matter and support me in resisting Dr. Gilbert's insubordination and defiance of all authority.

"My personal relations with him are those required by the situation. I have lost all respect for him but must treat him with courtesy as he is in my cabin and my mess. I stood his personal conferences until he became so insulting in his language that I was obliged to turn such matters over to Burrage with whom I can talk without becoming outraged. The first arrival here was a signal for an insult so pronounced that Burrage who was present told me later that he failed to see how I kept my temper and refrained from knocking him down."[36]

The captain's letter continued with example after example of supposed problems caused by Gilbert. Thomas closed his letter by writing:

"Pardon my tale of woe. I assure you it is forced out of me for I fully intended to keep silence till the completion of the cruise, but I simply must exhaust all chances to rid myself of the presence of Dr. Gilbert in the close communion we now enjoy! [sic]."[36]

Gilbert reported to Jordan in late July, discussed his problems with Thomas, and described the progress of the cruise. He wrote:

"Your letter[37] to Captain Thomas was well calculated to straighten matters out, even had it found him in the same mood as before. During our cruise to Hawaii, however, he received from some quarter a sudden illumination. We began to work days, nights, and Sundays, in wholly unprecedented fashion, with the sounding properly subordinated to dredging, the amount of work in any locality being left in my hands. They suddenly awakened to the fact that I would have a word to say concerning the date of departure for San Francisco. No other motive appeals to them, so I can congratulate you and all of us that you were able to apply it so effectively. The result has been that in 17 days were made nearly 100 dredge hauls, almost one-third the entire number made during the Hawaiian cruise thus far; a comment on previous work! If we continue working at the same rate, we shall be awaiting you on the 18th [of August] with our task measurably done. We leave tonight for Kauai and Bird Island."[38]

According to Gilbert, trawling was difficult around the island of Hawaii as the bottom was rough or barren. In most locations, the available dredging area was confined to within the 400 fathom line. He indicated that their work would be completed by 18 August.[38, 39]

Thomas again wrote Dunlap from Honolulu in mid-August. This long letter was a combination of progress report and bitter complaint about Thomas' relationship with Gilbert. This letter also highlighted the perceived differences in view point of the two antagonists:

"Many thanks for your condolences and your action in the case of Gilbert vs. Thomas. Since Dr. Jordan was here Dr. Gilbert has completely changed his tactics and has been as affable, polite and considerate as any one could ask. Just what caused this complete reversal I am at a loss to understand, but it must have been something that Dr. Jordan said to him without my knowledge. But no man takes me in twice by similar actions and the decent treatment of the past month or so cannot wipe out the decidedly reverse previously . . . . . I truly was never treated in a like manner in my life and I shall never permit anything of the kind to occur again even at the risk of doing myself injustice with the powers that be. Since I discovered that night work would help amazingly in the way of "satisfying" the two Doctors, night work has been the portion of the scientists congregated on board the *Albatross* and they did not appreciate it to its fullest extent. But it has entirely completed the work laid down by both scien-

[36]Thomas to the Commissioner, dated Honolulu 2 July 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[37]Jordan to Thomas, dated Apia, Samoa, 18 July 1902. This letter was not received by Thomas until at least 25 July when the *Albatross* returned to Honolulu. In this letter, Jordan indicated to Thomas that he had received Gilbert's memorandum of 25 June 1902 listing "unfinished work." Jordan essentially supported Gilbert in all respects and reiterated that Gilbert was in charge of all decisions concerning when and where to sample. Thomas immediately replied to Jordan, writing that "As between objects laid down by you and by the Commission and objects pointed out by Dr. Gilbert, I have no hesitation in arriving at the conclusion to adhere to the former and disregard the latter." Thomas defended his work and claimed the best record of any during the *Albatross* fisheries history (Thomas to Jordan, dated Honolulu 29 July 1902). Thomas forwarded to the Commissioner a copy of both Jordan's letter and Thomas's reply, as well as further comment. Thomas argued that the work desired by Jordan would be entirely completed by the time of Jordan's arrival in Honolulu on 18 August and therefore the letter was of little consequence. Thomas, however, again protested the implication that he, Thomas, was under orders from either Jordan or Gilbert, writing "I am entirely willing to accept and have done so constantly on this cruise, suggestions but to have an officer of my age, rank and experience placed under the orders of an irresponsible college professor such as Dr. Gilbert, is repugnant to my views and I cannot bring myself to believe that the Commission has any sympathy with such a state of affairs" (Thomas to Commissioner, dated Honolulu 30 July 1902). All NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

[38]Gilbert to Jordan, dated Honolulu 30 July 1902. CHGP, SUA, SC 58

[39]According to Thomas, extensive night work satisfied Gilbert, and the desired work would be completed by 18 August. Thomas to the Commissioner, dated Honolulu 26 July 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4.

tific heads and we are now awaiting the arrival of the *Sonoma* with Dr. Jordan to consult with him and receive his final 'depart in peace, bless you my children.' "[40]

Thomas continued his letter to Dunlap by describing the difficulties a Naval officer underwent in serving civilians at sea. He wrote: "I am afraid you do not quite appreciate the feelings of a naval officer placed under the command of one office when he feels that he is being placed under several other peoples orders . . . ."

Thomas cited the relevant Naval regulations and drew examples of his recent experiences aboard the *Albatross*:

"You will observe that nothing is clearer than that but two persons may be look to for orders or be regarded as higher authority in the Commission's service and nothing is said regarding a shifting of such authority to others in any walk of life . . . . . And here was the rock upon which Dr. Gilbert split. He could not be made to comprehend where his functions began and mine ceased or the contrary—he was 'the whole thing.'"[40]

Captain Thomas indicated he would be leaving the ship and would not continue his assignment. He recommended, "You gentlemen should never permit him [Gilbert] to appear in a similar capacity on board the *Albatross*, whoever commands her, for while he is a fine scientist in his line and otherwise, he is not fit to deal with responsible questions or people." Thomas was proud of his accomplishments during the cruise, noting that they had

". . . generally done an amount of work that I never would have believed could be accomplished at first. But in doing all this, some 1400 soundings, we have made 397 dredging stations, all but 43 being bottom work, the 43 surface net work; we have filled up every jar, bottle and crock that we brought along with specimens and bought a lot more, have used 10 bbls of alcohol and then began on formaline . . . ."[40]

The captain continued his summary by comparing the accomplishments of the *Albatross* with that of the *Challenger*. However, his anger and bitterness continued to surface:

"I resent the idea that seems to prevail on the Pacific coast that the *Albatross* is a mere annex to Stanford University. She belongs to the Fish Commission — an idea that I seek to keep to the fore at all times and in all future expeditions. I trust an assistant who will have the same broad notion will be sent to have entire charge of her scientific work."[40]

According to Thomas's letter, Jordan was due in Honolulu on August 18. The *Albatross* was due to leave for San Francisco shortly thereafter.

After arriving in San Francisco (Anonymous, 1902b), however, the feud between Thomas and Gilbert continued unabated. Frederic Chamberlain, the Fish Commission biologist assigned to the ship, reported to Thomas that Gilbert had removed some fishes which were contained in the ship's permanent collection. According to Chamberlain, the fishes in this collection ". . . have been obtained from time to time since the *Albatross* has been in commission, being selected on account of their oddity, peculiar appearance, or some such point as will make them of most interest to visitors as illustrations of the scientific work of the vessel."[41] In his report, Chamberlain added:

"During the interval between the departure of the 'Albatross' from San Francisco and her arrival in Honolulu, Dr. Gilbert and Mr. Snyder examined a number of these specimens. At my request Dr. Gilbert labeled those that he identified. In course of conversation he remarked that he was unable to identify a few of the specimens and that he believed them to be undescribed species. He further said that as such they should not remain on the vessel but that he would take them from the exhibit jars and place them in the collection to be made on the cruise, with which they would be shipped to Stanford University, remarking at the same time that the empty jars could be filled up with 'common stuff.' At this time I again asked him to please make a note of whatever he took out. Somewhat later I again asked Dr. Gilbert to hand me a list of the specimens he had removed, and was met by the statement that 'as they were not on charge' it would be unnecessary to furnish a list. I do not know how many nor what specimens were removed but am informed by the sailors in charge of the laboratories that about eight jars were emptied."[41]

Thomas forwarded Chamberlain's report to the Commissioner on 12 September, requesting that he order Gilbert to return the specimens. In his letter, Thomas argued:

"The collection of specimens belonging to the ship is of the greatest interest to scientific people and others visiting on board and should be kept intact. That they are not 'on charge' cannot excuse any attempt to acquire them for Stanford University or for the private collection of any person under the temporary employ of the Commission and as such in full charge of the scientific department of the ship."[42]

The issues raised in this letter subsequently reached Jordan. Although Jordan's letter to Gilbert has not been found, Gilbert's response has. On 26 September 1902, he wrote Jordan explaining:

". . . . While engaged in labeling the exhibition series, I came across six or eight small fishes which I was unable to identify with the literature at hand. These were taken out of the exhibition jars and placed in the study series, where they now are. As soon as their scientific status is determined it is the intention to report the matter to the Commissioner, and ask instructions as

[40]Thomas to Dunlap, dated Honolulu 15 August 1902. NA, RG 22, E 63, Records of the *Albatross*.

[41]Chamberlain to Thomas, dated San Francisco 1 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[42]Thomas to the Commissioner, dated San Francisco 12 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

to the final disposition to be made of the specimens."[43]

Gilbert further explained that the specimens were transferred on or about 15 March and that no criticism or comment was made until now, 6 months later. He concluded:

"The charge which he [Thomas] now makes, that I attempted to acquire these specimens for Stanford University or for a private collection, is a malicious falsehood and constitutes behaviour unbecoming an officer or a gentleman. It certainly appears that scientific men in the temporary employ of the Commission should be protected against gratuitous attacks of this nature."[43]

At the same time that Thomas was concerned over the removal of fishes from the special exhibit aboard the *Albatross*, he and Gilbert were feuding by letter over the "ship's mess." According to Gilbert, he loaned $25 to Thomas to help pay for the groceries purchased for the officer's mess. Gilbert argued in a letter to Thomas dated 8 September:

"You will recall that the twenty-five dollars of mine which you now hold was voluntarily advanced by me as a loan, in view of the fact that you were temporarily embarrassed financially, and were under the necessity of making purchases of fresh provisions for our mess. That such was your own understanding of the case is evidenced by the further fact that you, of your own motion, offered to return to me the money in Honolulu, on or about the next payday. Knowing from your conversation that you were still somewhat short of funds, I invited you to retain the sum until the end of the cruise. I was sufficiently astonished when at the end of the cruise you announced your intention to retain possession of that sum until you should run over your mess accounts. Whatever those accounts may show, you must agree, I think, that you can have no claim upon a sum of money which came into your possession under the circumstances and in the way you described. Will you not, therefore, return it to me at your earliest convenience."[44]

Thomas's direct reply to Gilbert has not been found. Gilbert, however, replied to Thomas on 11 September:

"We are neither of us deceived by your letter of the 10th inst. You cannot explain your offer to return me the money in Honolulu on any such plea as that set up in your letter. But perhaps you will deny the fact. The question of excess board over that allowed by the Commission has nothing to do with this twenty-five dollars. I have certainly not asked you to pay for the pleasure of furnishing me with meals, nor had I any intention of doing so. One prefers however to have the satisfaction of paying his bills after they are presented, instead of having property that is undeniably his 'held up' by a prospective creditor. There is a humorous side of course to such an episode. I rather enjoy the recollection that I originally furnished this money out of excess of good nature and a desire to be accommodating. I trust you may also enjoy the thought. I can certainly afford the situation, if you can."[45]

Thomas replied to Gilbert on 12 September, continuing the debate. He argued:

"I acknowledge the receipt of your communication of the 11th instant and in reply beg leave to say that the explanation of my offer to return the $25 in question shortly after our arrival at Honolulu was due to the fact that the indications at that time were that the amount allowed by the Commission would cover your mess bill but I ascertained later that it would not do so. As you declined receiving it I thought no more about it till I told you I would remit the amount due you after obtaining the settlement with the grocers, which is the procedure that would be adopted by any mess in the naval service. I prefer to remit the full amount and bear any excess out of my own pocket to having anything further to do with you in any way and I enclose a check for the same, which I thank you to acknowledge. I shall forward copies of your letters to the Fish Commission for its information."[46]

Thomas sent copies of this letter to the Fish Commission with a detailed defense of his handling of the "mess account" and his dealings with Gilbert. He concluded his defense by writing:

"It has remained for Dr. Gilbert alone of all the people with whom I have been associated to question my personal honesty and I resent such imputation but I have no recourse but to fully inform the Commission as to his action to the end that no future commanding officer of this ship should be subjected to such treatment from him, for I trust the Commission will see that he is not a fit person to be placed in contact with gentlemen under any circumstances."[47]

Thomas continued his broadside against Gilbert, describing in detail what he considered Gilbert's interference with the internal operations of the vessel. He accused Gilbert of interviewing crew members of the vessel while in Honolulu in April to determine if engine repairs were indeed required, as Thomas had reported, and, if so, the length of time such repairs should require.[48] Thomas wrote: "As I say, I can afford to treat with silent contempt his personal insults but on learning of this

[43]Gilbert to Jordan, dated Stanford University 26 September 1902. CHGP, SUA, SC 58.

[44]Gilbert to Thomas, dated Stanford University 8 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[45]Gilbert to Thomas, dated Stanford University 11 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[46]Thomas to Gilbert, dated San Francisco 12 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[47]Thomas to the Commissioner, dated San Francisco 14 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[48]Hepburn to Thomas, dated Honolulu 19 April 1902. NA, RG 22, Reports for the Steamer *Albatross* for 24 March–3 August 1902; Folder *Albatross*, Box 6, 150/1/19/4. Lieutenant junior grade Arthur Japy Hepburn (1877–1964), U.S.N., was an officer aboard the *Albatross* in 1902 and also in 1906 (Dunn, 1996b). A graduate of the U.S. Naval Academy in 1897, Hepburn reached the rank of Admiral in 1936. Record of Officers, U. S. Navy, Arthur Hepburn, Military Service Records, M1328, Vol. 30, p. 89, NA; Anonymous, 1968).

transaction I was simply furious and it was only with the greatest effort that I succeeded in stifling my natural desires to free the ship from the insult of Dr. Gilbert's presence by remembering that he had been placed in his position by the Commission to effect certain work and I should not allow my personal feelings to interfere with the accomplishment of that duty."[49]

Thomas closed this communication with comments about Gilbert's "attitude" after meeting in Honolulu with Jordan. Thomas wrote:

"It is only fair to Dr. Gilbert to state that after his consultation with Dr. Jordan, on June 18th, he changed his whole course of action and was, of course, met more than half way in efforts to preserve a peaceful relation with the officers of the ship. What Dr. Jordan said to him I do not know, but if he said anything it was based entirely on Dr. Gilbert's own reports for I never alluded in any way to any differences on board the ship in the expedition. It was my aim always to treat Dr. Gilbert and his party with all courtesy both official and private and it was only when his course forced me in order to retain my own self respect to deal with him through the executive officer or in writing, that any severance in outwardly friendly intercourse could have been detected."[49]

The debate over the "mess bill" continued in force. On 15 September, Gilbert acknowledged receipt of Thomas's letter of 12 September, as well as the check for $25. Gilbert renewed his offer "to settle with you for any deficiency in the appropriations made by the Fish Commission to cover my mess account, if you will present a bill therefore in proper form."[50] Gilbert defended his position, arguing:

"On previous cruises which I have made on the *Albatross*, I have been received as a regular member of the mess to which I belonged, and have at the end of each month paid my *pro rata* amount of the expenses of that month, it being also understood that the accounts of the mess were open to inspection. On the cruise just finished, a different method was adopted, inasmuch as all the special officers of the Commission, in the Cabin and in the Wardroom, were charged the maximum sum allowed by the Commission for their maintenance, with out reference to the monthly expenses of the mess. This procedure was never officially brought to my attention, and so long as the messes in question were securing a slight but welcome surplus over the actual cost of the service rendered, it was a matter in which I had no concern. But when, in my case, a deficit is declared instead of a surplus, and I am asked to settle the balance, I am certainly within my rights when I demand that you should present me first a formal bill, with an opportunity to inspect the mess accounts should I desire to avail myself of that privilege. It is to be hoped that this 'is the course that would be adopted by any mess in the naval service.'"[50]

This letter prompted a further response by Thomas on 17 September: "I acknowledge the receipt of your communication of the 15th instant and as previously intimated do not desire any further correspondence with you in any way. Should you have anything to say concerning our recent official connection you may do it through the Commission of Fish and Fisheries."[51]

Thomas forwarded the above two letters to the Commissioner, with a detailed defense of his method of handling the ship's mess accounts. Thomas' accounting found the wardroom mess to be about $20 per person short of covering expenses. His parting shot at Gilbert was:

"Here was a cruise on which the scientists temporarily engaged went to do what pleases them most: to gain name and fame in the scientific world for discoveries in a virgin field. Why should the Commission bear their personal expenses in giving them a summer's outing to do what they most desire? The ship could have been loaded down with naturalists anxious to pay their own way and give their services gratuitously."[52]

The final scenario in this tale arose over an article published in the *San Francisco Examiner* on 12 October 1902 (Anonymous, 1902c; Lewis, 1902). The article, about Gilbert and the *Albatross* expedition to Hawaii, concentrated on the collection of unusual fishes during the cruise, including a description of a "curious eel, whose eyes have disappeared and have been substituted by two patches of phosphorescence."

The article caused an outburst from Thomas who, on 13 October, wrote the Commission, complaining:

"This article was evidently inspired by Dr. Gilbert and the dishonesty of his methods is well illustrated by the description of the 'Curious Eel....' This eel is one of the specimens which Dr. Gilbert removed from the exhibition jars belonging to the ship and had no earthly connection with the Hawaiian collection and it will be observed in the text describing the same in this article, that it is not expressly stated that it came from this cruise but the inference is undoubted. It should also be noted that where there has been a single specimen captured it will be reserved for future students of Stanford."[53]

Three days later, Thomas mailed a "Mea Culpa" to the Commissioner, writing as follows:

"1. I beg leave to confirm my night message of this date, as follows: "Referring my letter number one sixty-six dated October 'thirteenth, request no action be taken until receipt letter written to-day.'

2. At the time my letter #166 was written it was my belief that the 'curi-

[49]Thomas to the Commissioner, dated San Francisco 14 September 1902. NA, RG 22, Records of the *Albatross*.

[50]Gilbert to Thomas, dated Stanford University 15 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[51]Thomas to Gilbert, dated San Francisco 17 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[52]Thomas to the Commissioner, dated San Francisco 17 September 1902. NA, RG 22, E 63, Records of the *Albatross*.

[53]Thomas to the Commissioner, dated San Francisco 13 October 1902. NA, RG 22, E 63, Records of the *Albatross*.

ous eel' under discussion had been removed, with other specimens, from the laboratory by Dr. Gilbert. To-day, in making his inventory, Mr. Chamberlain was astounded to discover the eel, in its usual museum jar, but in a different place. My remarks, relating to the eel only, as expressed in my letter #166 are retracted."[54]

Synopsis

The two antagonists finally parted ways. Thomas requested a transfer from the *Albatross*[55] and was appointed captain of the U.S.N. *Bennington* in late 1902. He continued his Naval career, rising to Rear Admiral, which culminated in his appointment as Commander-in-Chief, U.S. Pacific Fleet in 1911. Thomas retired from active duty in 1912, having served the Navy for over 40 years. He died in 1919 (Anonymous, 1943).

Gilbert continued his research at Stanford University, including additional stints on the *Albatross* in 1903, 1904, and 1906 (Hedgpeth, 1945). He served as Naturalist-in-Charge of the *Albatross* in 1906 during a cruise in the Bering Sea and in waters off Kamchatka and Japan (Dunn, 1996b), and records from this cruise provided no evidence of any conflict between Gilbert and the captain of the vessel, LeRoy Mason Garrett.

By 1910 Gilbert had turned his attention to the study of Pacific salmon, *Oncorhynchus* spp., and had become the leading authority in North America on these economically important fishes (Dunn, 1996a). Gilbert retired from Stanford University in 1925, continued his salmon research in 1926 and 1927, and died in 1928 (Dunn, In press). In memory of Gilbert, a new Bureau of Commercial Fisheries research vessel, stationed in Honolulu, Hawaii, was named the *Charles Henry Gilbert* (Strasburg and Yuen, 1960; Dunn, In press). Additionally, a new biology building at Stanford University was recently christened the "Charles H. Gilbert Biological Sciences Building" (Anonymous, 1991).

Despite the personal antagonism and conflict between these two strong personalities, the voyage of the *Albatross* to Hawaii in 1902 must be considered highly successful, based on the collections made, scientific papers published, and the discovery and description of specimens new to science. The fishes collected were taken to Stanford University for study, whereas the invertebrate taxa, and vertebrates other than fishes, were shipped to the Smithsonian Institution. In December of 1902, Gilbert sent five boxes of invertebrates to the National Museum of Natural History for scientific study. This was followed in January 1903 by another shipment of two boxes of crustaceans and one box of corals.[56]

About 27 scientific papers were published based on collections or observations made on this expedition, resulting in significant contributions to knowledge (Table 2). The papers by Gilbert (1905) and Snyder (1904) described a total of 17 new genera and 119 new species of fishes. Gilbert's contribution, on the deep-sea fishes collected, described a remarkable 15 new genera and 94 new species of fishes in a single paper. Nineteen publications concern-

[54]Thomas to the Commissioner, dated San Francisco 16 October 1902. NA, RG 22, E 63, Records of the *Albatross*.

[55]Thomas to Dunlap, dated Honolulu 15 August 1902. NA, RG 22, E 63, Records of the *Albatross*.

[56]In a letter to the Director, U.S. National Museum, Gilbert wrote: ". . . I am forwarding to the Museum such of the collections of the *Albatross* Hawaiian Expedition of 1902, as will be reported upon by members of the Museum staff." Listed were two boxes of Crustacea, two boxes of corals, and one box of Mollusca. Gilbert to the Director, U.S. National Museum, dated Stanford 16 December 1902. Smithsonian Institution Archives (SIA), Record Unit (RU) 213, Division of Fishes (DF), 1865–1941, Records, Box 7, Folder 9, and SIA, RU 305, Registrar, 1834–1958, Accession Records, File No. 40409. In January 1903, Gilbert sent the Museum a box of corals and two more boxes of Crustacea. He asked that the Crustacea be directed to Miss Mary J. Rathbun and the corals to Dr. J. Wayland Vaughn of the Museum (SIA, RU 305, File 40520). In April 1903, Gilbert sent a porpoise (*Pseudorca crassideus)* skeleton to the museum. See also True (1903) for information on other mammal specimens collected during the *Albatross* expedition to Hawaii.

Table 2.—Selected publications resulting from the 1902 expedition of the U.S. Fish Commission Steamer *Albatross* in Hawaiian waters.

Author	Subject	Comments
On fishes		
Gilbert (1905)	Deep sea fishes of the Hawaiian Islands	15 new genera and 94 new species
Snyder (1904)	Shorefishes of the Hawaiian Islands	Two new genera and 25 new species
Other than fishes		
Berry (1909; 1913; 1914)	Cephalopods of the Hawaiian Islands	One new genus and 33 new species
Clark (1912)	Echinoderms of the Hawaiian Islands	Distribution and diagnosis
Clark and Agassiz (1907a, b; 1908; 1909)	Echinoderms of the Hawaiian Islands	Four new genera and 12 new species
Coe (1906)	Nemertean worms collected by the *Albatross*	Two new species
Fisher (1903a)	Birds of the Hawaiian Islands	Distribution and checklist
Fisher (1903b)	Birds of Laysan Island	Behavior
Fisher (1903c)	A new sea-bird from the Leward Islands	One new species
Fisher (1904)	Laysan albatross	Behavior
Fisher (1906)	Review of starfishes of the Hawaiian Islands	One new family, eight new genera, and 52 new species
Fisher (1907)	Review of sea cucumbers of the Hawaiian Islands	One new genus and 19 new species
Fisher (1911)	A new starfish from Hawaiian waters	One new genus and one new species
Mayer (1906)	Medusae collected from Hawaiian waters	Two new species
Nutting (1905)	Hydroids and schizopods of the Hawaiian Islands	Two new families, two new genera, and 29 new species
Ortmann (1905)	Crustacean larvae of the Hawaiian Islands	Distribution and diagnosis
Pilsbry (1907)	Barnacles of Hawaii	Eight new species
Rathbun (1906)	Brachyuran and macuran crabs of the Hawaiian Islands	Two new genera, 80 new species, and three new sub-species
Richardson (1903; 1910)	Descriptions of isopods collected	Three new genera and three new species
Treadwell (1906)	Polychaet annelids of the Hawaiian Islands	Twenty-seven new species
True (1903)	Notes on porpoises	

ing various invertebrate groups resulted in the description of three new families, 22 new genera, and 259 new species. Additionally, a definitive review of the shorefishes of the Hawaiian Archipelago was later published by Jordan and Evermann (1905), as part of the overall investigation of the fishes of the Hawaiian Archipelago.

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Literature Cited

Abell, A. I., B. J. Fleming, A. P. Levack, T. T. McAvoy, and L. J. Mannion. 1955. A history of the United States of America. Fordham Univ. Press, N. Y., 700 p.

Allard, D. C., Jr. 1978. Spencer Fullerton Baird and the U.S. Fish Commission. Arno Press, N. Y., 424 p.

Anonymous. 1902a. Goes to Hawaii. Dr. Gilbert leaves the latter part of this week to take charge of scientific expedition. Daily Palo Alto, Feb. 24, 1902, 20(36):3, col. 1. [School newspaper, Stanford Univ., Palo Alto, Calif.]

_____ . 1902b. Absent on leave. Professor Chas. H. Gilbert, Zoology, [returns] from cruise of U.S. Fish Commission steamer "Albatross" in Hawaiian waters. Daily Palo Alto, Sept. 3, 1902, 21(1), p. 1, col. 4. [School newspaper, Stanford Univ., Palo Alto, Calif.]

_____ . 1902c. A resume' of the work of the deep-sea dredgers: from a statement by Dr. C. H. Gilbert Am. Mag. Suppl. to San Franc. Examiner, Oct. 12, 1902, p. 6–7, col. 4.

_____ . 1943. Chauncey Thomas, Jr. Who-was-who in America, vol. 1, 1897–1942. A. N. Marquis Co., Chicago, p. 1225.

_____ . 1968 Arthur Japy Hepburn. Who-was-who in America, vol. 4, 1961–1968. Marquis-Who's Who, Inc., Chicago, p. 431.

_____ . 1991. New quarters for biologists. Stanford Univ. Campus Rep, Sept. 11, 23(40): 1, col. 1.

Berry, S. S. 1909. Diagnoses of new cephalopods from the Hawaiian Islands. Proc. U. S. Natl. Mus. 37:407–419.

_____ . 1913. Some new Hawaiian cephalopods. Proc. U.S. Natl. Mus. 45:563–566.

_____ . 1914. The cephalopods of the Hawaiian Islands. Bull. U.S. Bur. Fish. 32:255–362.

Bowers, G. M. 1904. Report of the Commissioner. *In* Report of the Commissioner of Fish and Fisheries for the year ending June 30, 1902, pt. 28:16–17.

Cart, T. W. 1968. The Federal fisheries service, 1871–1940. Unpubl. M.S. thesis, Univ. of N.C., Chapel Hill, 128 p.

Cattell, J. M., and D. R. Brimhall (Editors). 1921. American men of science. 3rd ed. Sci. Press, N. Y., 808 p.

Clark, H. L. 1912. Hawaiian and other Pacific echini: the Pedinidae, Physomatidae, Stomopneustidae, Echinidae, Temnopleuridae, Strongylocentrotidae, and Echinometridae. Mem. Mus. Comp. Zool. 34(4):209–383.

_____ and A. Agassiz. 1907a. Preliminary report on the echini collected, in 1902, among the Hawaiian Islands by the U.S. Fish Commission steamer "Albatross" in charge of Commander Chauncey Thomas, U.S.N., commanding. Bull. Mus. Comp. Zool. 50:231–259.

_____ and _____ . 1907b. Hawaiian and other Pacific echini: based upon collections made by the U.S. Fish Commission steamer "Albatross" in 1902, Commander Chauncey Thomas, U.S.N. commanding. The Cidaridae. Mem. Mus. Comp. Zool. 34:1–42.

_____ and _____ . 1908. Hawaiian and other Pacific echini: based upon collections made by the U.S. Fish Commission steamer "Albatross" in 1902, Commander Chauncey Thomas, U.S.N. commanding. The Salenidae. Mem. Mus. Comp. Zool. 34:47–132.

_____ and _____ . 1909. Hawaiian and other Pacific echini: based upon collections made by the U.S. Fish Commission steamer "Albatross" in 1902, Commander Chauncey Thomas, U.S.N. commanding. The Echinothuridae. Mem. Mus. Comp. Zool. 34:133–204.

Coe, W. R. 1906. Nemerteans of the Hawaiian Islands collected by the steamer *Albatross* in 1902. Bull. U.S. Fish Comm. 23(3):975–986.

Davis, J. 1958. In memorium: Walter Kenrick Fisher. Auk 75:131–134.

Dunbar, K., and C. Friday. 1994. Salmon, seals, and science: The *Albatross* and conservation in Alaska, 1888–1914. J. West 33(4):6–13.

Dunn, J. R. 1996a. Charles Henry Gilbert (1859–1928): an early fishery biologist and his contributions to knowledge of Pacific salmon (*Oncorhynchus* spp.). Rev. Fish. Sci. 4(2):133–184.

_____ . 1996b. Charles Henry Gilbert (1859–1928), naturalist-in-charge: the 1906 North Pacific expedition of the steamer *Albatross*. Mar. Fish. Rev. 58(1–2):17–28.

_____ . In press. Charles Henry Gilbert (1859–1928): Pioneer ichthyologist of the American West. *In* T. W. Pietsch and W. D. Anderson, Jr. (Editors), Collection building in ichthyology and herpetology. Am. Soc. Ichthyol. Herpetol., Spec. Publ. 3.

Fisher, W. K. 1903a. Birds of Laysan and the Leeward Islands, Hawaiian group. Bull. U.S. Fish Comm. 23(3):767–807.

_____ . 1903b. Notes on birds peculiar to Laysan Island, Hawaiian group. Auk 20: 384–397.

_____ . 1903c. A new procelsterna from the Leeward Islands, Hawaiian group. Proc. U.S. Natl. Mus. 26:559–563.

_____ . 1904. On the habits of the Laysan Albatross. Auk 21:8–20.

_____ . 1906. The starfishes of the Hawaiian Islands. Bull. U.S. Fish Comm. 23(3):982–1130.

_____ . 1907. The holothurians of the Hawaiian Islands. Proc. U.S. Natl. Mus. 32(1555):637–744.

_____ . 1911. *Hyalinothrix*, a new genus of starfishes from the Hawaiian Islands. Proc.U. S. Natl. Mus. 39:659–664.

_____ . 1940. When Joseph Grinnell and I were young. Condor 42:35–38.

Gilbert, C. H. 1905. The deep-sea fishes of the Hawaiian Islands. *In* D. S. Jordan and B. W. Evermann (Editors), The aquatic resources of the Hawaiian Islands, p. 577-713. Bull. U.S. Fish Comm. 23(2).

Hamersly, L. R. 1902. The records of living officers of the U.S. Navy and Marine Corps. L. R. Hamersly Co., N.Y., 7th ed., p. 217.

Hanna, G. D., and S. M. Peers. 1944. Barton Warren Evermann. Dic. Amer. Biogr. 21 (Suppl. 1) to Dec. 31, 1935. Chas. Scribner's Sons, N.Y., p. 291.

Hedgpeth, J. W. 1945. The United States Fish Commission steamer *Albatross*. Am. Neptune 5(1):5–26.

Hobart, W. L. (Editor). 1995. Baird's legacy: the history and accomplishments of NOAA's National Marine Fisheries Service, 1871–1996. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-18, 46 p.

Hubbs, C. L. 1943. John O. Snyder. Copeia 1943(4):265–266.

_____ . 1964. David Starr Jordan. Syst. Zool. 13(4):195–200.

Jennings, M. R. 1987. Frederic Morton Chamberlain (1867–1921): pioneer fishery biologist of the American West. Fisheries 12(6): 22–29.

Jordan, D. S. 1922. The days of a man: being memories of a naturalist, teacher and minor prophet of democracy. World Book Co., Yonkers-on-Hudson, N.Y, 2 vols., 710, 906 p.

_____ and B. W. Evermann. 1902. Preliminary report on the investigation of the fishes and fisheries of the Hawaiian Islands. Rep. Comm. Fish Fish. 1901, 27:355–380.

_____ and _____ . 1903a. Description of a new genus and two new species of fishes

from the Hawaiian Islands. Bull. U.S. Fish. Comm. 22:209–210.
_____ and _____ . 1903b. Descriptions of new genera and species from the Hawaiian Islands. Bull. U.S. Fish Comm. 22:161–208.
_____ and _____ . 1905. The aquatic resources of the Hawaiian Islands. Part I. The shore fishes of the Hawaiian Islands, with a general account of the fish fauna. Bull. U.S. Fish Comm. 23(pt. 1), 574 p.
Kawaguchi, K., and H. G. Moser. 1984. Stomiatoidea: development. *In* H. G. Moser, W. J. Richards, D. M. Cohen, M. P. Fahay, A. W. Kendall, and S. L. Richardson (Editors), Ontogeny and systematics of fishes, p. 181–184. Am. Soc. Ichthyol. Herpetol., Spec. Publ. 1.
Lewis, A. 1902. Rarest of rare fish brought here by the *Albatross*, dredged from a depth of two miles under the sea. Am. Mag. Suppl. to San Franc. Examiner, 12 Oct. 1902, p. 6–7, col. 1.
Mayer, A. G. 1906. Medusae of the Hawaiian Islands collected by the steamer *Albatross* in 1902. Bull. U.S. Fish Comm. 23(3):1131–1143.
Myers, G. S. 1951. David Starr Jordan, ichthyologist. Stanford Ichthyol. Bull. 4(1):2–6.
Mooney, J. L. (Editor). 1991. Dictionary of American naval fighting ships. Naval Hist. Cent. Dep. Navy, Wash., D.C., Vol. I, pt. A, p. 135–138.
Nutting, C. C. 1905. Hydroids of the Hawaiian Islands collected by the steamer *Albatross* in 1902. Bull. U.S. Fish Comm. 23(3):931–959.
Ortmann, A. E. 1905. Schizopods of the Hawaiian Islands collected by the steamer *Albatross* in 1902. Bull. U.S. Fish Comm. 23(3):961–973.
Palmer, T. S. 1933. Obituary: Barton Warren Evermann. Auk 50:465.
Peterson, S. 1988. America's first full-time deep-water research vessel. Log Mystic Seaport 39(4):147–155.
Pietsch, T. W., and J. R. Dunn. In press. Early collection building in Puget Sound and adjacent waters: the 1880 expedition of David Starr Jordan and Charles Henry Gilbert. *In* T. W. Pietsch and W. D. Anderson, Jr. (Editors), Collection building in ichthyology and herpetology. Am. Soc. Ichthyol. Herpetol., Spec. Publ. 3.
Pilsbry, H. A. 1907. Hawaiian cirripedia. Bull. Bur. Fish. 26:179–190.
Rathbun, M. J. 1906. The brachyura and macura of the Hawaiian Islands. Bull. U.S. Fish Comm. 23(3):827–930.
Richardson, H. 1903. Isopods collected at the Hawaiian Islands by the U.S. Fish Commission steamer *Albatross*. Bull. U.S. Fish Comm. 23(3):817–826.
_____ . 1910. Description of a new parasitic isopod from the Hawaiian Islands. Proc. U.S. Natl. Mus. 38:645–647.
Smith, H. M. 1904. Report on the inquiry respecting food-fishes and the fishing-grounds. Pt. 28. *In* Rep. Comm. Fish Fish. 1902:111.
Snyder, J. O. 1904. A catalogue of the shore fishes collected by the steamer *Albatross* about the Hawaiian Islands in 1902. Bull. U.S. Fish Comm. 22:513–538.
Strasburg, D. W., and H. S. H. Yuen. 1960. Progress in observing tuna underwater at sea. J. Cons. Int. Explor. Mer 26:80–93.
Townsend, C. H. 1924. The passing of the "Albatross." Nat. Hist. 24:619–620.
Treadwell, A. L. 1906. Polychaetous annelids of the Hawaiian Island collected by the steamer *Albatross* in 1902. Bull. U.S. Fish Comm. 23(3):1145–1181.
True, F. W. 1903. Notes on a porpoise of the genus *Prodelphinus* from the Hawaiian Islands. Bull. U.S. Fish Comm. 23(3):809–815.
USFC. 1904. Records of the dredging and other collecting stations of the U.S. Fish Commission steamer *Albatross* in 1901 and 1902. *In* Rep. Comm. Fish Fish. 1902, Pt. 38:397–431.
_____ . 1905. Aquatic resources of Hawaii and Samoa. *In* Rep. Comm. Fish Fish. 1903, p. 88–89.

Charles Henry Gilbert (1859–1928), Naturalist-in-Charge: the 1906 North Pacific Expedition of the Steamer *Albatross*

J. RICHARD DUNN

Introduction

Charles Henry Gilbert (1859–1928) was a pioneer ichthyologist and fishery biologist whose work is of particular significance to aquatic resources of the American west. Appointed by President David Starr Jordan[1] as the first chairman of the Zoology Department of Leland Stanford Junior University in Palo Alto, California in 1891, Gilbert (Fig. 1) was an active investigator of America's fish fauna from Panama to Alaska (Dunn, In press; Pietsch and Dunn, In press). Gilbert was Naturalist-in-Charge of several exploratory cruises of the Steamer *Albatross* (1888–90, 1902, 1906),[2] as a temporary employee of the U.S. Fish Commission and, later, the Bureau of Fisheries (Hedgpeth, 1945; Dunn, In press). He was strongly devoted to his work and possessed a demanding personality (Dunn, 1996a; In press). Gilbert's scientific leadership of the 1906 expedition of the *Albatross* from San Francisco to the Aleutian Islands, Bering Sea, and waters off Kamchatka, Sakhalin, and Japan is an example of his success and devotion to duty in face of severe hardships.

This cruise was conducted in the latter part of the era of exploration and description of new faunas and fisheries. The *Albatross* had engaged previously in wide-ranging exploratory ventures throughout the Pacific Ocean (Hedgpeth, 1945). This particular 1906 cruise was a multifaceted operation, first exploring the salmon fisheries of Alaska waters, then conducting general surveys of fisheries resources of the western North Pacific Ocean. As the Bureau put it: "In May [1906] the *Albatross* was dispatched upon an extended cruise in the northwestern Pacific and Bering Sea to make certain investigations in the interests of the salmon fisheries of Alaska and the general questions of geographic distribution of Pacific fishes and the relations of the faunas of Alaskan and Japanese waters . . ." (Bowers, 1906).

Just before this expedition, the Russo-Japanese War of 1904–05, fought over Manchuria and Korea, had concluded, with Japan the victor (Garraty and Gay, 1981),[3] but its lingering effects were evident to Gilbert and to the *Albatross*. Martial law was still in effect in Japan during that period, ports were closed to foreign vessels, and hundreds of floating mines from the conflict impeded the ship's progress and research. Severe storms interrupted the work, and typhoons caused damage and severe loss of life and property among commercial fishermen in the region. The captain of the *Albatross*, Lieutenant Commander LeRoy Mason Garrett (1857–1906), U.S.N. (Fig. 2), was lost

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ABSTRACT—Fishery science pioneers often faced challenges in their field work that are mostly unknown to modern biologists. Some of the travails faced by ichthyologist and, later, fishery biologist Charles Henry Gilbert (1859–1928) during his service as Naturalist-in-Charge of the North Pacific cruise of the U.S. Bureau of Fisheries Steamer Albatross *in 1906, are described here, as are accomplishments of the cruise. The vessel left San Francisco, Calif., on 3 May 1906, just after the great San Francisco earthquake, for scientific exploration of waters of the Aleutian Islands, Bering Sea, Kamchatka, Sakhalin, and Japan, returning to San Francisco in December. Because the expedition occurred just after the war between Japan and Russia of 1904–05 floating derelict mines in Japanese waters were often a menace. Major storms caused havoc in the region, and the captain of the* Albatross, *Lieutenant Commander LeRoy Mason Garrett (1857–1906), U.S.N., was lost at sea, apparently thrown from the vessel during a sudden storm on the return leg of the cruise. Despite such obstacles, Gilbert and the* Albatross *successfully completed their assigned chores. They occupied 339 dredging and 48 hydrographic stations, and discovered over 180 new species of fishes and many new species of invertebrates. The expedition's extensive biological collections spawned over 30 descriptive publications, some of which remain today as standards of knowledge.*

[1]Jordan (1851–1931) was President of Leland Stanford Junior University from its founding in 1891 until he became Chancellor in 1913 (Myers, 1951). Earlier he had been Gilbert's major professor at Indiana University and became his mentor, colleague, and friend. Jordan was the preeminent ichthyologist of North America during the late 19th and early 20th centuries (Myers, 1951; Hubbs, 1964). His autobiography (Jordan, 1922) contains a treasure of information about early 20th century North American ichthyology and fisheries biology.

[2]Gilbert correspondence, National Archives (NA), Record Group (RG) 22, Entry (E) 63, Records of the *Albatross*.

[3]The Japan-Russia war of 1904–1905 was fought over Korea, as was the Japan-China war of 1894–1895. Japan defeated Russia, and the ensuing Treaty of Portsmouth awarded Japan certain rights in Manchuria and southern Sakhalin. Japan formally annexed Korea in 1910 (Garrety and Gay, 1981).

at sea during a heavy storm as the vessel was returning to the United States. Yet, despite these setbacks, the expedition may be considered a significant success, based on discovery of many specimens new to science, extensive biological collections, and the number of scientific publications resulting from the expedition.

The primary sources for this study are Gilbert's letters to his friend and mentor, David Starr Jordan.[4] Additional sources include annual reports of the *Albatross*[5,6] and personnel records and correspondence of Captain Garrett.[7] Positions for dredging and hydrographic stations for this cruise are contained in Bureau of Fisheries Document 621 (Anonymous, 1907).

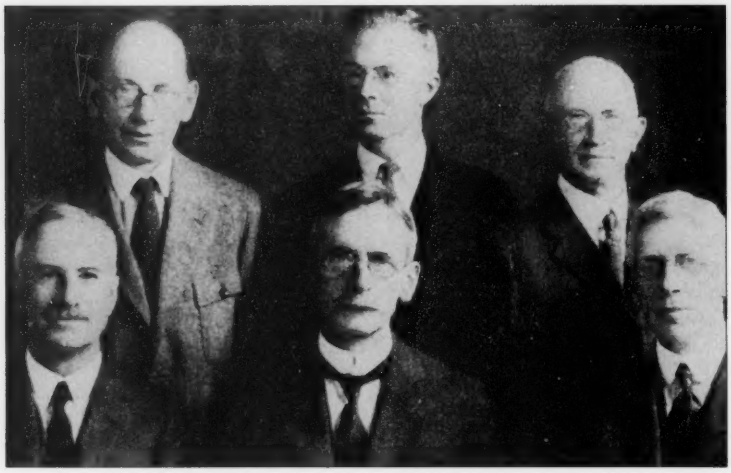

Figure 1.—Faculty of Zoology Department, Stanford University, in about the 1920's. From back row, left, are Edwin C. Starks, Walter K. Fisher, Charles H. Gilbert, John O. Snyder, Harold Heath, and George C. Price. Courtesy of Mark R. Jennings and the Department of Special Collections and University Archives, Stanford University, Calif.

Figure 2.—Lt. LeRoy Mason Garrett, front row left, aboard the USS *Marblehead* in 1899 (NH 46581). Courtesy of U.S. Naval Historical Center, Washington, D.C.

The *Albatross* Expedition of 1906

Gilbert, as chief naturalist and ichthyologist of the *Albatross* (Fig. 3), was assisted in his scientific duties by Austin Hobart Clark,[8] naturalist assigned to the vessel, and L. M. Tongue, captain's clerk. Accompanying the vessel were Stanford University professors Harold Heath[9] and John Otterbein Snyder,[10] Charles Victor Burke (1882–1958), one of Gilbert's graduate students, and another Stanford student, Michitaro Sindo (Snyder, 1912a), as well as Professor Harry Beal Torrey of the University of California (Anonymous, 1906a).[11] Garrett had served as captain of the *Albatross* since October 1904 (Hedgpeth, 1945).[12]

Various sampling gears were used, including beam trawls, handlines, ring

[4]Gilbert correspondence, NA, see footnote 2; Charles Henry Gilbert Papers (CHGP), Stanford University Archives (SUA), SC 58, Stanford, Calif.

[5]Annual Report, Fisheries Steamer *Albatross*, for the year ending 30 June 1906 (Lieutenant Commander L. M. Garrett, U.S.N., Commanding). NA, RG 22, E 63, Records, U.S. Fish and Wildlife Service, Box 6. Folder *Albatross*, Reports and Correspondence.

[6]Annual Report, Fisheries Steamer *Albatross*, for the fiscal year ending 30 June 1907 (Lieutenant A. J. Hepburn, U.S.N., Commanding). NA, RG 22, E 63, Records, U.S. Fish and Wildlife Service, Box 6. Folder *Albatross*, Reports and Correspondence.

[7]Correspondence of Lt. Commander LeRoy Mason Garrett, U.S.N. NA, RG 24, Bureau of Navigation Correspondence, Files 1699, 10–14.

[8]Clark (1870–1948), Curator of Echinoderms at the Museum of Comparative Zoology, Harvard University (Cattell and Cattell, 1938; Palmer, 1948), was aboard the vessel as a temporary employee of the Bureau of Fisheries. He also observed and collected birds during the expedition, saving over 180 skins and describing them in a paper (Clark, 1910) in which he also provides a succinct overview of the itinerary of the *Albatross* (see also Clark, 1907a, b).

[9]Heath (1868–1951) was a Professor in the Department of Zoology, Stanford University. His expertise was mainly in invertebrate zoology (Cattell and Cattell, 1938).

[10]Snyder (1867–1943) was a Professor in the Department of Zoology, Stanford University, whose main interest was in fishes (Hubbs, 1943).

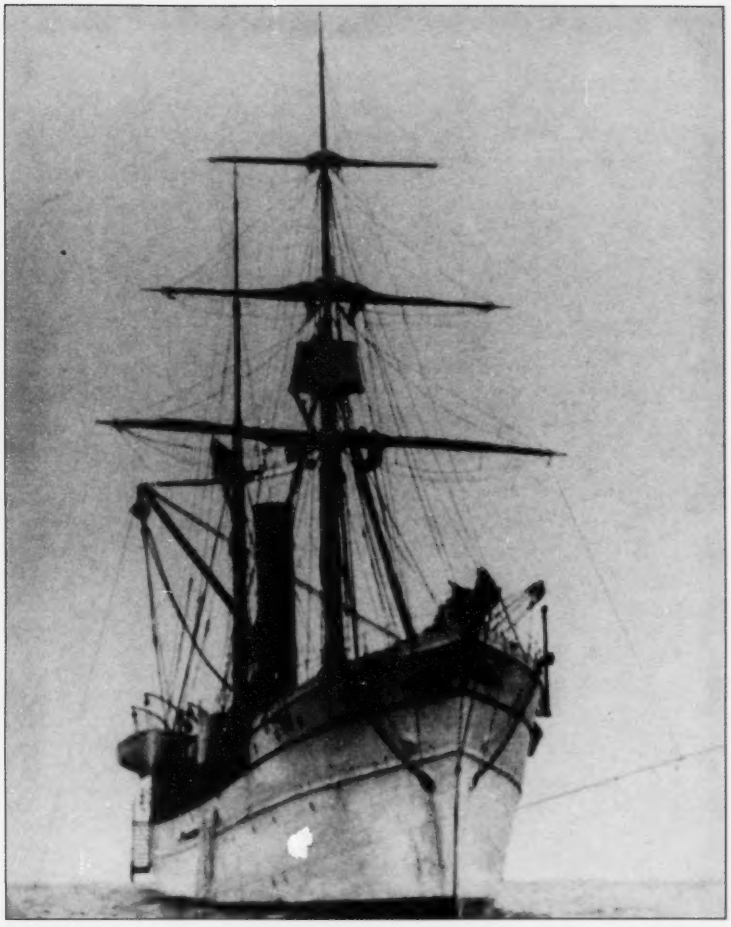

Figure 3.—U.S. Bureau of Fisheries Steamer *Albatross*. Courtesy U.S. National Archives, Washington, D.C.

nets, and various dredges, and plankton nets. Work included dredging and other sampling, collecting on shore at various locations, and hydrographic and meteorological observations (Anonymous, 1907). The expedition made significant collections of biological materials, including invertebrates, fishes, birds, and a few marine mammals.

After a 3 May 1906 departure, delayed by the great San Francisco earthquake,[13,14] the *Albatross* steamed northward (Table 1, Fig. 4), arriving in Tacoma, Wash., on 9 May for a brief stay in drydock for cleaning and painting. On 11 May she moved to the U.S. Naval Shipyard at Bremerton, Wash., to fill vacant personnel positions from the Receiving Ship *Philadelphia*, and then left for Seattle the following day to pick up fresh provisions and to receive Gilbert and Torrey, who had arrived from Palo Alto. After a coaling stop in Union Bay, British Columbia, from 13 to 17 May, the vessel proceeded to Dutch Harbor, Alaska, arriving the afternoon of 24 May.[15]

From 24 May to 16 June, the ship explored the Bering Sea, mainly off Bowers Bank and Petral Bank, and finally arrived off Petropavlovsk, Kamchatka, on 16 June (Table 1). Some 40 dredge and 27 hydrographic stations were occupied and several shore collecting expeditions were made during this initial leg of the cruise (Table 1; Anonymous, 1907).[16] Collections, at times, were extensive as the captain's annual report noted during work on Petral Bank: "Richer ground for the trawl could hardly be found, for two hauls of the 12' Tanner [net] fairly swamped the Laboratory, operations in this line being suspended for a time until the scientific staff could clear decks once more for action."[17]

Three days were spent in Petropavlovsk for ship maintenance and to draw fresh water before continuing the expedition to the southwest. A five-vessel American cod fleet hailing from San Francisco was fishing in the Okhotsk Sea, and according to the Captain of the *Castle*, fish were so plentiful in this region that there had so far been no need to fish elsewhere.[18]

[11]Torrey (1873–1954) was a Professor at the University of California, Berkeley, whose expertise was in reproduction and taxonomy of invertebrates (Cattell, 1906).

[12]Garrett was an 1879 graduate of the U.S. Naval Academy, who served on a variety of naval vessels (and was previously assigned to the *Albatross* in 1883–85). He was promoted to lieutenant commander in 1901 (Hamersly, 1902). Garrett was appointed Captain of the *Albatross* in 1904 at the instigation of Alexander Agassiz (1835–1910), former director of the Museum of Comparative Zoology, Harvard University. Agassiz made the request to Senator Henry Cabot Lodge (1850–1924) of Massachusetts (Letter, Agassiz to Lodge, 13 August 1904, see footnote 6). For more on Agassiz, see Windsor (1991); a biographical sketch of Lodge appears in Malone (1933).

[13]The *Albatross* was pressed into emergency service after the great earthquake in San Francisco on 18 April 1906, and her departure was delayed. The ship carried fresh water and food from the Naval Paymasters Stores at Fort Mason, Calif., to those in need, and transported refugees and their effects. She was relieved from this duty on 28 April and finally departed San Francisco on 3 May. NA, RG 22, E 63, Box 6 (see footnotes 5 and 6).

[14]Snyder, Burke, and Sindo joined the ship in San Francisco. Gilbert and Torrey boarded the vessel later in Seattle. NA, RG 22, E 63, Box 6 (see footnote 5).

[15]NA, RG 22, E 63, Box 6 (see footnote 5).

[16]After departing Dutch Harbor on 28 May, the vessel passed near the Bogoslof Islands. A volcano had recently erupted and Garrett wrote that "a large volume of steam was seen apparently rising from the water midway between the two islands, Fire and Castel. As the islands were approached, it was seen that a new cone had been thrown up, which was hidden by clouds of vapor from a more distant view as the wind from the S.W. drifted the vapor toward the ship." NA, RG 22, E 63, Box 6 (see footnote 5).

[17]NA, RG 22, E 63, Box 6. See footnote 5.

[18]NA, RG 22, E 63, Box 6. See footnote 5.

Table 1.—Route of the Steamer *Albatross* in 1906, showing number of stations sampled (D = dredge station, H = hydrographic station), based on Anonymous (1907).

Dates	Route	No. of stations	Chart location
3–18 May	San Francisco to Union Bay, British Columbia	1D	1
19–24 May	British Columbia to Dutch Harbor, Alaska	5D	2
25–29 May	Dutch Harbor to Atka Island, Alaska	3D	3
29–31 May	Atka Island to Bowers Bank, Bering Sea	2D	4
1–3 June	On Bowers Bank	9D, 3H	5
4–5 June	From Bowers Bank to Petral Bank, Bering Sea	6H	6
5 June	On Petral Bank	6D, 12H	6
5–7 June	From Petral Bank to Agattu Island	2D, 6H	
9 June	Agattu Island to Attu Island	2D, 3H	7
11–12 June	Attu Island to Komandorskiye Islands[1]	2D, 3H	
14–16 June	Komandorskiye Islands to Bering Island	7D	8
16 June	Bering Island to Petropavlovsk, Kamchatka	1D	9
20 June	Petropavlovsk to west coast of Kamchatka	4D, 1H	10
21 June	On Codfish Banks, Sea of Okhotsk	2D	11
22 June	Codfish Banks to Kuril Islands	1D	12
24–27 June	Kuril Islands to Hakodate, Hokkaido, Japan	6D	13
16–18 July	Hakodate to Sado Island, Sea of Japan	11D	14
19 July	Sado Island to Nanao, Hondo, Japan	4D	15
21–23 July	Nanao, Hondo to Tsuruga, Hondo, Japan	14D, 2H	16
24–25 July	From Tsuruga to Dogo Island, Sea of Japan	6D	17
26–28 July	Dogo Island to Matsu Shima, Sea of Japan	10D, 1H	18
30 July–1 Aug.	Matsu Shima to Nagasaki, Japan	14D	19
2 Aug.	Korea Strait, vicinity Oki Shima	11D	20
8 Aug.	From Nagasaki to Kagoshima Gulf, Japan	7D	21
9–11 Aug.	10–20 miles SW of Goto Islands, East China Sea	15D	22
11–12 Aug.	10–20 miles SW of Koshika Islands, East China Sea	11D	23
13 Aug.	About 90 miles WSW of Kagoshima Gulf, East China Sea	6D	24
14–15 Aug.	In Colnett Strait	11D, 3H	
16 Aug.	Off Kagoshima Gulf, East China Sea	4D	25
16–17 Aug.	In Kagoshima Gulf	9D	
20–23 Aug.	Kagoshima to Kobe, Japan	15D	26
17 Aug.–1 Sept.	From Kobe to Yokohama, Japan	20D, 1H	27
19–20 Sept.	From Hakodate to Otaru, Japan, Sea of Japan	9D	28
21–22 Sept.	Otaru to Korsakov, Sakhalin Island	7D	29
23 Sept.	Gulf of Tartary, off SW coast of Sakhalin Island	8D	30
24 Sept.	Aniwa Bay, near Korsokov, Sakhalin Island	6D, 1H	31
25 Sept.	Korsokov to east coast Sakhalin Island	3D	32
26–27 Sept.	Off eastern coast of Sakhalin Island, Okhotsk Sea	12D, 2H	32
28–29 Sept.	Okhotsk Sea	5D	33
30 Sept.	North entrance to Yezo Strait	3H	
30 Sept.	In Yezo Strait	3D, 1H	34
1 Oct.	Eastern end Hokkaido, Pacific Ocean	2D, 1H	35
2–3 Oct.	South coast Hokkaido	10D, 1H	36
10 Oct.	Hokodate to Yokohama, Japan	7D	37
12–16 Oct.	Suruga Gulf, Japan	23D	38
17 Oct.	Entrance to Suruga Gulf	2D, 2H	38
19–20 Oct.	Off Omai Saki Light	7D	39
23–25 Oct.	Sagami Bay, Hondo, Japan	5D	40
26 Oct.	Uraga Strait, Gulf of Tokyo	6D	40

[1]Commander Islands.

Hakodate, Japan, was reached at noon on 27 June (Table 1; Fig. 5). During this period of about 56 days out of San Francisco, some 53 dredging and 34 hydrographic stations had been occupied, and many shore collections were made as opportunities arose. The published record (Anonymous, 1907) reveals that the dredging gear was torn or otherwise damaged on 12 occasions.

The first part of the expedition, through the Aleutian Islands, Bering Sea, and around Kamchatka, was considered relatively smooth, and trawl collections were beyond expectations. The Captain wrote:

"The collections thus far made have been in advance of the most sanguine expectations. The collections have grown so bulky that it will be necessary to box them and either ship or store them here [Hakodate] in order to make room for further work when the vessel again starts out, which should be in a week or ten days."[19]

On 28 June, Gilbert and Sindo went to Tokyo "to confer with the Japanese authorities and to expedite, if possible, the authorization necessary for the vessel to continue the cruise."[20] They returned to the vessel on 10 July, bringing news that a satisfactory answer from the Imperial Government was to be expected at any time.[21]

On 11 July Gilbert wrote Jordan from Hakodate:

"We had a fairly successful cruise across [the] Bering Sea, stopping at all the points indicated in the instructions and enjoying a number of successful hauls in shallow water. In deep water, our efforts were in vain. We have a number of apparently undescribed forms and have secured much needed new material in species represented by only one or two specimens.

There is no end to the Liparids!"[22]

Gilbert also described his attempts to secure permission from Japanese government officials to fish in their territorial waters:

"We reached this 'promised land' two weeks ago but are as yet without permission to take up our work.[23] I proceeded at once to Tokyo, and worked through the U.S. Embassy and Dr. Mitsukuri. Everyone is most cordial and helpful, but the inertia of the official machine is apparently beyond computation. It needs your name and presence to make things move promptly. However, the delay cannot long continue."[24]

After further delay attempting to obtain such permission, Gilbert ordered the vessel to proceed. As Captain Garrett wrote:

"On Saturday, July 14, the Commanding Officer decided to get underway the following Monday and, in default of any word from Tokyo, to work down the west coast of Nipon as far as Nano. Accordingly, early in the morning of the 16th, a telegram announcing our movements was sent to the American Embassy in Tokyo, and the *Albatross* got

[19]NA, RG 22, E 63, Box 6. See footnote 5.

[20]NA, RG 22, E 63, Box 6. See footnote 5.

[21]Heath joined the vessel in Hakodate on 10 July. NA, RG 22, E 63, Box 6 (see footnote 6).

[22]Gilbert to Jordan, 11 July 1906, CHGP, SUA, SC 58, Stanford, CA.

[23]Snyder and Sindo left the vessel on 11 July to collect samples on shore. NA, RG 22, E 63, Box 6 (see footnote 5).

[24]Gilbert to Jordan, 11 July 1906, CHGP, SUA, SC 58 (see footnote 22).

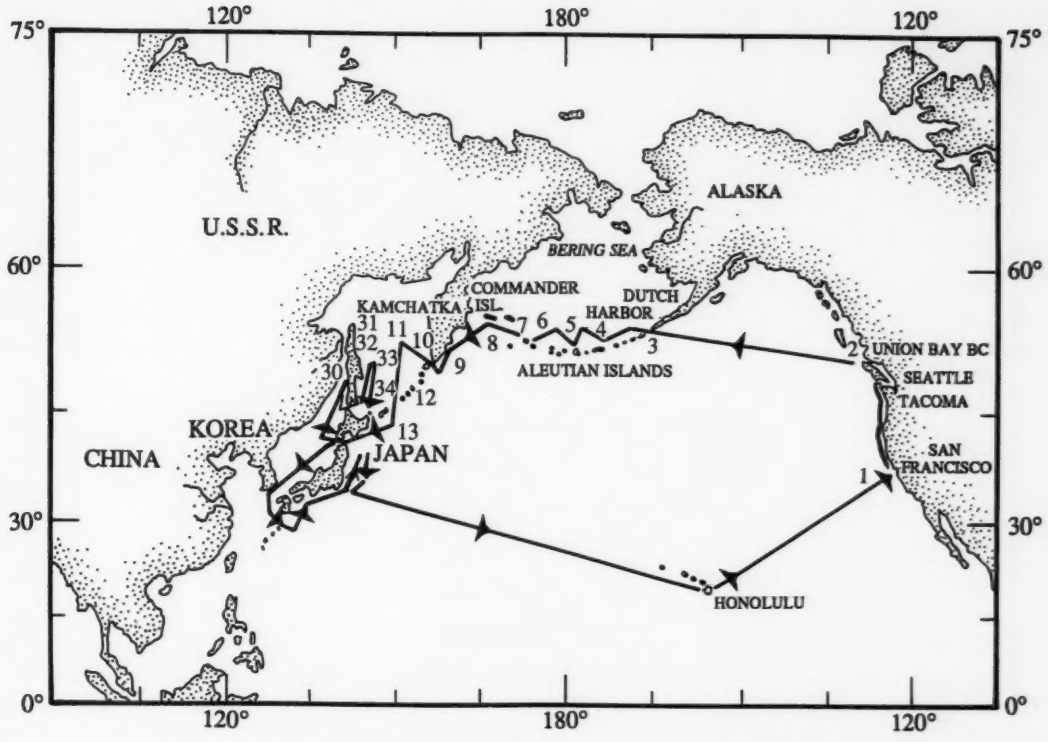

Figure 4.—Schematic route of the Steamer *Albatross* to the Japanese archipelago and return to the United States in 1906.

underway and proceeded out through the Straits of Tsugaru into the Sea of Japan. Formal authorization for the *Albatross* to operate was received from the Japanese Foreign Office on 19 July while the vessel was in anchorage at Ebisu Byochi."[25]

Gilbert wrote to Jordan on 20 July. In the letter he described the problems which had delayed the vessel's progress:

"After waiting nearly three weeks at Hakodate for the final word of assent of the Japanese authorities we put to sea without it and began our work four days ago. You may judge how far we are behind our schedule. It will be necessary to work later in the fall than we had planned and also to omit some of the itinerary. I fear the off-lying islands to the southeast cannot be visited by the ship. Another vexatious feature which occasions delay in this first part of the cruise is the menace from floating mines. We learn of six steamers which have been sunk during the last few months and thus consider it wise to cut down our running at night to a minimum."[26]

Concerning the danger from these mines, the Captain recorded:

"It was known from the official notices published by the Japanese Government that several hundred floating mines, planted by both Japanese and Russian forces during the recent war, were adrift in the Sea of Japan, and a sinister emphasis was given to this information by the reports, from time to time, of mines being stranded along the western coast of Japan, or of vessels damaged or destroyed through collision with them at sea. Navigation of these waters, under the circumstances, possessed an element of excitement not usually attendant upon dredging alone; and it was deemed advisable to slow down to steerage way after dark, or anchor for the night when possible. This course was followed for awhile, an extra vigilant lookout being kept, until it was found that the necessary progress could not be made by dredging all day and lying practically stopped all night."[27]

Finally, the Captain noted that as the vessel proceeded south the chances of any mines left "up stream" grew slim. Hence, after leaving Nanao, "full speed was used as freely by night as by day."[27]

The vessel proceeded southward from Hakodate through Tsuruga Straits into the Sea of Japan. Sampling in the Sea of Japan continued in a southwest-

[25]NA, RG 22, E 63, Box 6 (see footnote 6).

[26]Gilbert to Jordan, 20 July 1906. CHGP, SUA, SC 58.

[27]NA, RG 22, E 63, Box 6 (see footnote 6).

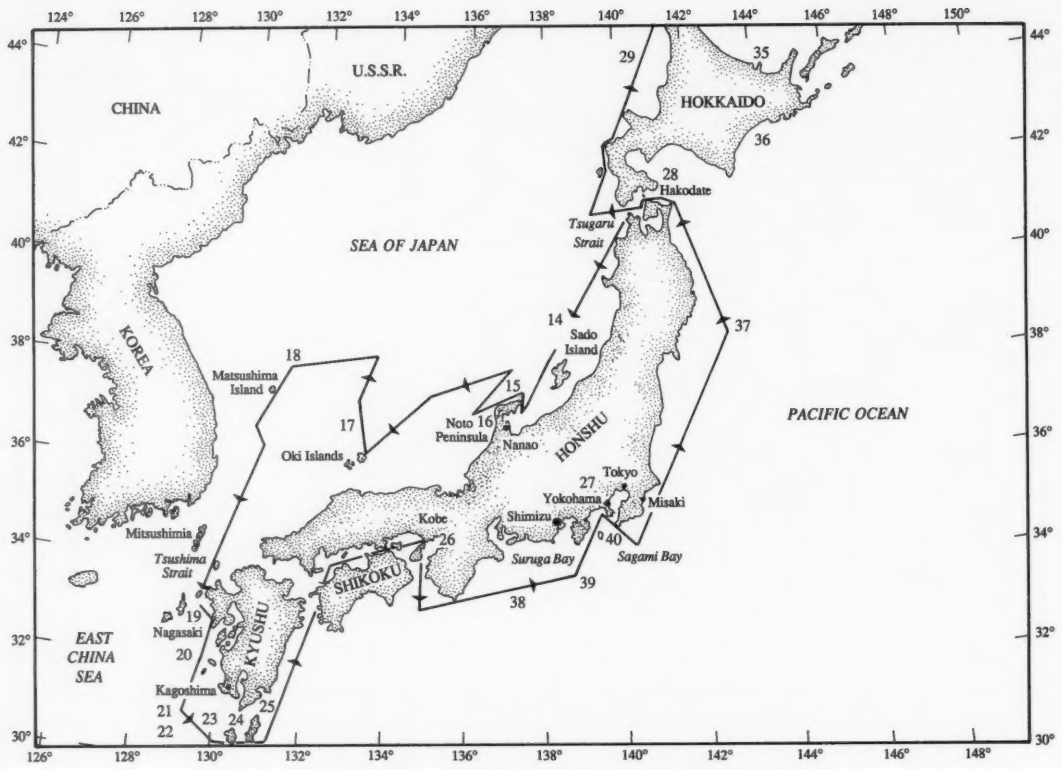

Figure 5.—Schematic route of the Steamer *Albatross* in Japanese waters in 1906.

erly manner to near Sado Island, the Noto Peninsula, the Oki group of islands off Korea, and then north, reaching Nagasaki on 3 August. The solicitous and helpful attitude of Japanese officials was noted by Captain Garrett:

"At 5:00 o'clock [12 July] in the evening the *Albatross* came to anchor off Tsuruga. The customs and police officials, courteous at all times, were more than usually so at this port, offering every kind service in their power and going so far even as to investigate the prices demanded by the various merchants from whom we were purchasing provisions and stores in order to prevent any overcharge."[28]

The trawling was successful, as some 59 dredging stations were occupied between mid-July and 1 August (Table 1).[29,30] Gilbert noted that collections made in Tsugaru Straits and at Sado Island resembled Arctic fauna, consisting of liparids, cottids, and zoarcids. None of the characteristic bathybial forms were taken, but many undescribed species were collected.[31]

In a further communication to Jordan from Nagasaki on 6 August, Gilbert expressed his disappointment in the depauperate fauna:

"We failed to connect with any floating mines in the Sea of Japan, and arrived here duly a few days ago. The Sea of Japan was incredibly barren at all points below the warm surface waters, and even with regard to these, I can assure you a shipwrecked mariner would starve to death hunting sea growth on the beach at either Dogo or Matsushima Islands."[32]

After departing Nagasaki on 8 August,[33] the *Albatross* explored waters to the southwest and westward, then moved to the Gulf of Kagoshima, arriving 16 August. Off the Korean coast, Gilbert found the number of individual fishes collected to be greater than elsewhere, but the as-

[28]NA, RG 22, E 63, Box 6 (see footnote 6).

[29]Gilbert and colleagues collected at on-shore sites wherever possible; for example, they visited the fish market at Sado Island on 19 July, in Saigo Harbor, Dogo Islands, on 25 July, and at Matsu Shima on 29 July. NA, RG 22, E 63, Box 6 (see footnote 6).

[30]Goto and Higurashi of Tokyo joined the vessel at Tsuraga, Japan, on 23 July. NA, RG 22, E 63, Box 6 (see footnote 6).

[31]Gilbert to Jordan, 20 July 1906. CHGP, SUA, SC 58 (see footnote 26).

[32]Gilbert to Jordan, 6 August 1906. CHGP, SUA, SC 58.

[33]Harold Heath left the ship on 8 August and proceeded by rail to Yokohama and then by ship to San Francisco. NA, RG 22, E 63, Box 6 (see footnote 6).

semblage was "a modified Bering Sea fauna down to Tsushima Straits."[34]

On August 16, Gilbert reported to Jordan: "We left Nagasaki on the eighth and have thus had eight days experience with the fauna of Southern Japan. Nowhere can be found a more absolute contrast than between the two deep faunas separated by Tsushima Straits. I do not recall a single species common to the two areas."[35] He noted that the southern Japanese fauna was rich in deep-water fishes. Further, since leaving Nagasaki, he had added some 40 or 50 species of fishes to the known Japanese fauna, several of which were "doubtless new." He commented on the oppressive heat (from 82°F at night to 88°F during day), but the seas were "phenomenally calm all the same, so we can drift about at night and take up our work wherever we find ourselves next morning."[35] Gilbert was concerned, however, about the possibly of typhoons as the vessel headed toward Yokohama.

Sampling continued off the southwest of Kyushu Island through 20 August, then the vessel proceeded northeast into the Japan Current. She arrived off Kobe on 23 August, avoiding contact with typhoons the whole time, although sampling was hindered somewhat by inclement weather. The vessel reached Yokohama on 3 September.

On 4 September Gilbert wrote Jordan from Tokyo:

"We have reached this point in our round up, after having spent some interesting days dodging typhoons in the middle of the Kuro Shiroo [Kurishio].[36] One passed a short distance to the eastward of us and struck Tokyo and Yokohama with much force. Another lingered for days in the Loo Choos, constantly threatening, but finally went up the Formosa and China route, into the Sea of Japan, and out by Hokkaido. Our good fortune has been phenomenal. We worked four days in the middle of the typhoon season, off Shiroo Misaki, the most dangerous cape of the Japanese coast, and weather which permitted dredging, not withstanding the danger signals flying from every flagstaff."[37]

Dredging in this region proved difficult, Gilbert explained:

"The Kuro Shiroo is fully as rich as we thought it would prove, but far more difficult to investigate, owing to the great rapidity of the surface current and the differential motion of the lower strata. During our first two days, we did not succeed in getting our trawl on the bottom at all, and in subsequent work more than half the hauls have been unsuccessful. Time passes rapidly, I fear it will be a reconnaissance instead of a thorough investigation — but the results will be rich, if not exhaustive."[37]

Gilbert indicated that the ship would leave for Hokkaido and Sakhalin in about 10 days. They planned to spend 30 days sampling enroute.[37]

Gilbert next wrote Jordan from Yokohama on 12 September. The ship was stormbound because of a "raging typhoon" and, Gilbert wrote, "we had nearly two months of extreme heat, however, with the mercury never below 82° at night and ranging to 90° in the day and the air was mostly saturated!"[38,39]

The ship left Yokohama on 14 September enroute to Hakodate, and on 18 September proceeded to the west through the Straits of Tsugaru. Sampling was conducted to the west and north of Hokkaido to Sakhalin, and then returned to Hakodate on 4 October.

Upon the completion of the cruise around northern Hokkaido and southern Sakhalin on 5 October, Gilbert wrote Jordan from Hakodate:

"Making this so late in the season, we were threatened with storms and disaster, but the customary good fortune of the ship prevailed. We had regular "Indian Summer" weather and were able to dredge industriously fourteen out of the sixteen days we were away from Hakodate."[40]

Gilbert reported to Jordan that they intended to finish as rapidly as possible the work off Matsushima Bay and in Suruga and Sagami Bays, as they were pressed for time, as usual. He noted that after the completion of the work around the end of October, the *Albatross* would quickly refit for the voyage to San Francisco and should arrive the middle of December.[40]

In mid-October, Gilbert wrote Jordan from Shimizu:

"We came down the coast from Hakodate with a northerly gale piping in the rigging, the first storm we have experienced on our cruise. And now we have dredged four days on the lower slopes of Fuji San. We find the district better for scenery than for dredging. The bottom of the Bay is green mud, of extreme tenacity and barrenness..."[41]

Gilbert closed his letter by noting they would finish their work in just 11 days. He indicated that he would return to San Francisco by mail steamer.[41]

In early November, Gilbert reported to Jordan from Yokohama. Concerning the completion of the cruise, he wrote:

"We ran in here a few days ago, having taken our last dredge haul in Uraga Channel at the entrance to Tokio [Tokyo] Bay. So many known forms had not come to our nets, so much more valuable work was left unfinished. I found it hard to bring the investigation to a close."[42]

Gilbert further noted the tragic effect of stormy weather that merely delayed the *Albatross:*

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[34]Gilbert to Jordan, 6 August 1906. CHGP, SUA, SC 58 (see footnote 32).

[35]Gilbert to Jordan, 16 August 1906. CHGP, SUA, SC 58.

[36]The Kuroshio is the current flowing northeast between Formosa and lat. 35°N (e.g., Sverdrup et al., 1942).

[37]Gilbert to Jordan, 4 September 1906. CHGP, SUA, SC 58.

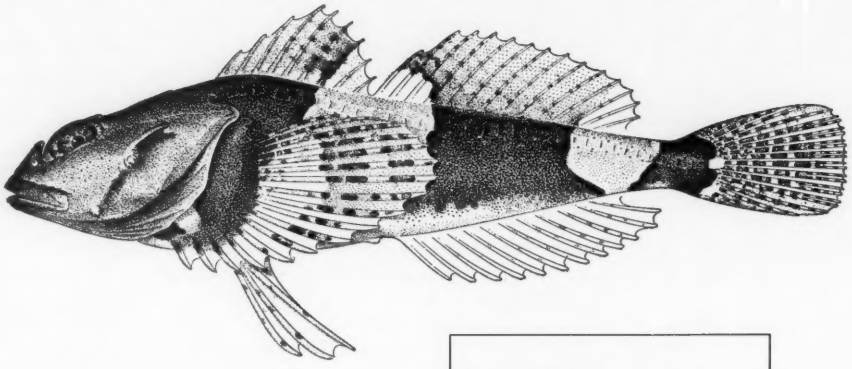
[38]Gilbert to Jordan, 12 September 1906. CHGP, SUA, SC 58.

[39]Torrey left the ship on 10 September to return to San Francisco on the S.S. *Magnolia*. Goto and Higurashi returned to Tokyo on 11 September. NA, RG 22, E 63, Box 6 (see footnote 6).

[40]Gilbert to Jordan, 5 October 1906. CHGP, SUA, SC 58.

[41]Gilbert to Jordan, 16 October 1906. CHGP, SUA, SC 58.

[42]Gilbert to Jordan, 4 November 1906. CHGP, SUA, SC 58.



REPORT ON THE JAPANESE MACROUROID FISHES COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" IN 1906, WITH A SYNOPSIS OF THE GENERA.

By Charles Henry Gilbert and Carl L. Hubbs,
Of Stanford University, California.

NEW CYCLOGASTERID FISHES FROM JAPAN.

By C. H. Gilbert and C. V. Burke,
Of Stanford University, California.

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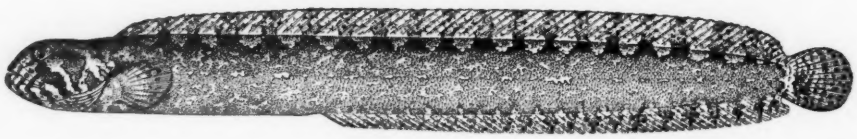
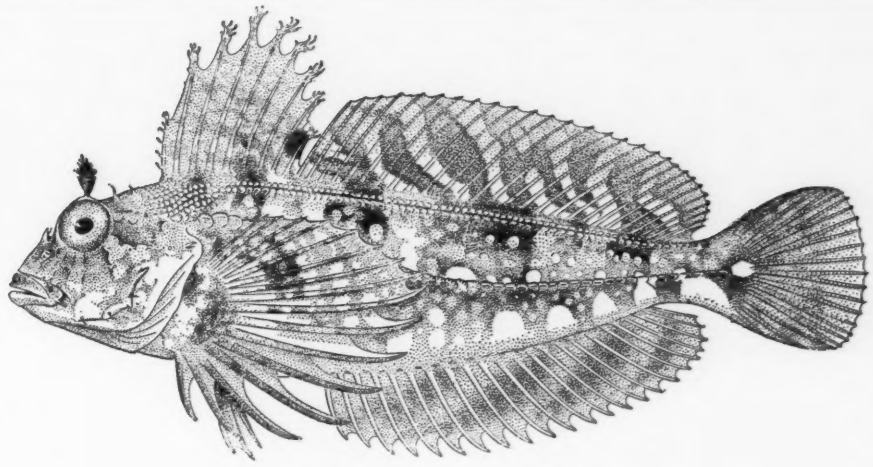
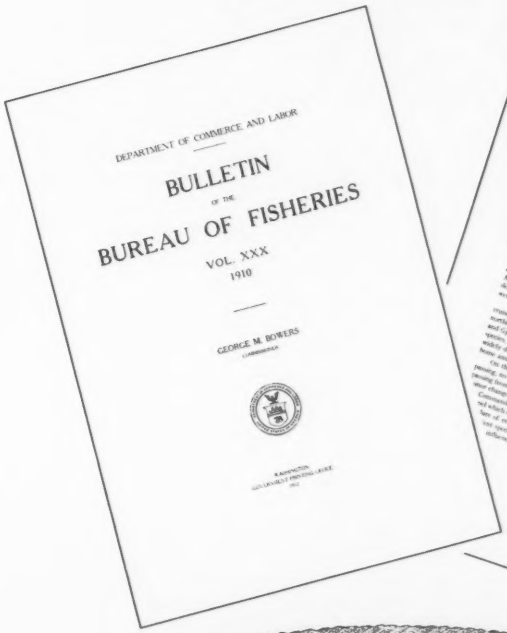
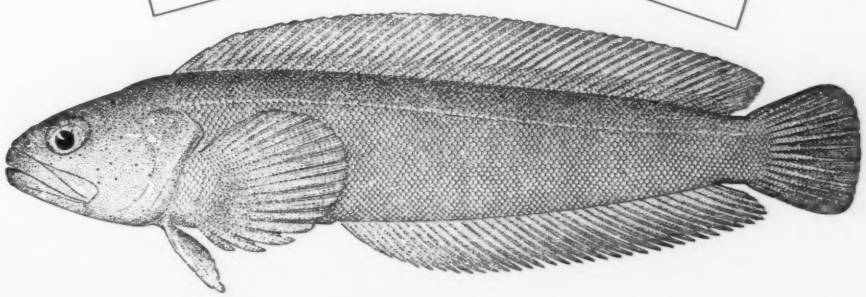


Facing pages: Selected examples from the many publications and illustrations from the 1906 cruise of the *Albatross*.




DEPARTMENT OF COMMERCE AND LABOR
BULLETIN
OF THE
BUREAU OF FISHERIES
VOL. XXX
1910
GEORGE M. BOWERS

FISHES FROM BERING SEA AND KAMCHATKA



"But the weather turned suddenly capricious and worse. It was during this time that a storm capsized fishing boats off the Goto Islands and drowned over seven hundred men. We were storm bound day after day. And then, when work was possible, we found to our disgust that these Bays are the least adapted for our kind of investigation of any Japanese territory we have attempted to work."[42]

Gilbert reported to Jordan that he would work in the fish collection at the Imperial University in Tokyo for a few days. He planned on sailing by steamer to San Francisco, arriving by the middle of December.[42]

The *Albatross* made her last dredge haul on 26 October in Sagami Bay. She had completed 339 dredge stations and 48 hydrographic casts during the expedition. The officers and members of the scientific staff of the *Albatross* were hosted at a luncheon in Tokyo in their honor on 5 November at the Imperial University (now University of Tokyo).[43] The vessel then proceeded to Yokohama to prepare for the run to San Francisco. Gilbert remained in Tokyo to work on collections of fishes at the Imperial University before returning to the U.S. by mail steamer.[43]

Tragedy at Sea: The *Albatross* Returns to San Francisco

The *Albatross* sailed from Yokohama on 10 November enroute to San Francisco via Honolulu. The ship encountered moderate weather for the first 3 days of her transit only to later encounter a tremendous storm. Lieutenant Arthur Japy Hepburn[44] reported, that "after five days of the most violent motion of the vessel, with decks continually awash and the living quarters only occasionally dry, all hatches and skylights battened down until it was a question whether one grew unconscious at night from sleep or from suffocation, all hands had reached about the limit of endurance."[45]

At about 1930 hours on the night of 21 November, when the vessel was about 500 miles from Honolulu, Captain Garrett was apparently sitting alone "on the poop, in a long reclining deck chair on the port or weather side..." of the ship. As the recorded proceedings of a Board of Inquest indicate (summarized by Hepburn):

"A sudden unusually violent lurch of the vessel to the starboard shot the chair across the slippery painted canvas deck with great velocity, bringing [it] up against the starboard rail with such force that the end of the chair was wrecked and a panel of wire lattice work between the deck and the rail was completely carried away, opening up like a door, no less than twelve good copper-wire seizings holding lattice to the battens being parted. Through the opening thus made, or, more probably, over the dangerously low rail itself, Captain Garrett went overboard."[46]

A plaintive cry from Garrett was heard, followed by shouts of "man overboard." Hepburn rushed up to the poop-deck and found the broken chair sticking through the rail. A life buoy was thrown in the water where the captain may have gone in.[47]

Hepburn assumed command of the vessel and initiated an immediate search, steaming in a complete circle around the buoy with the searchlight on. The search continued all night to no avail and, as recorded by Hepburn, "At daylight the next morning, about 6:10 a.m., I abandoned the search and continued on our way to this port [Honolulu], arriving inside at 10:30 a.m. this day [November 24]."[47]

Upon arrival in Honolulu, Hepburn immediately submitted his report of inquest to the commandant of the Naval Station, Rear Admiral S. W. Very. Admiral Very "ordered the Naval Station flag to fly at half-mast and at noon fired seven minute guns in memorium."[47,48]

The *Albatross* remained in Honolulu for repairs and cleaning until 2 December, when she departed for San Francisco. The run took 8 days, 10 hours, with the ship arriving off Black Point in San Francisco Bay at about 2200 hours on 10 December 1906,[49] marking the conclusion of a remarkable exploratory voyage of the Fisheries Steamer *Albatross* (Anonymous, 1906b).

Epilogue

The cruise of the *Albatross* to the North Pacific Ocean may be considered a marked success from both exploratory and biological standpoints. The expedition resulted in extensive biological collections. The ship's annual report noted that 90 cases of samples were loaded onto a railroad freight car in Sausalito, Calif., for transport to Palo Alto.[50] Much of the material was ultimately shipped to the U.S. National Museum for distribution to various specialists for future study. These samples formed the basis for a number of publications mainly describing new species, but also providing the basis for revisions of genera and families (Table 2). Gilbert authored or coauthored four of such works on fishes; others were authored by Burke, Snyder, and by Carl Levitt Hubbs, then a student of Gilbert's. Collectively these authors described about 180 new species of fishes taken on this cruise. The collections also contributed to a definitive review of the fishes of Japan by Jordan et al. (1913).

The expedition also provided specimens that resulted in publications on sea birds, siphonophores, isopods, and echinoderms, as well as other invertebrate taxa (Table 2). Descriptions of about 203 new species resulted from these studies. Samples from this cruise remain today for further study.

This voyage of the *Albatross* was just one of many important research cruises undertaken by the vessel. As Hedgpeth (1945) noted, the published works based

[43]NA, RG 22, E 63, Box 6 (see footnote 6).

[44]Lieutenant Arthur Japy Hepburn, U.S.N. (1877–1964) was second in command aboard the *Albatross* in 1906. He also served aboard the *Albatross* in 1902. Record of Officers, U. S. Navy, Arthur Japy Hepburn, Military Service Records, M1328, vol. 30, p. 89, NA. For more on Hepburn, see Anonymous, (1968) and Dunn, (1996a).

[45]NA, RG 22, E 63, Box 6 (see footnote 6).

[46]Record of proceedings of a Board of Inquest convened on board the U.S.F.S. *Albatross* in the case of LeRoy Mason Garrett, Lieutenant Commander, U.S. Navy, 22 November 1906. NA, RG 24, Files 1699, 10–14 (see footnote 6).

[47]NA, RG 22, E 63 (see footnote 6).

[48]A "minute gun" is a cannon fired at intervals of a minute as a signal of distress or in a military funeral ceremony (Random House, 1987).

[49]NA, RG 22, E 63 (see footnote 6).

[50]NA, RG 22, E 63 (see footnote 6).

Table 2.—Selected publications resulting in whole or in part from collections made aboard the *Albatross* on its 1906 research cruise to the Bering Sea, Kamchatka, and Japan.

Author	Subject	Comments
On Fishes		
Burke (1911)	Distribution of Liparidae	Relation between color of specimens and bathymetric distribution
Burke (1930)	Revision of Liparidae	1 new genus and 1 new species
Gilbert (1913)	Lantern fishes of Japan	12 new species
Gilbert and Burke (1912a)	List of fishes from the Bering Sea and Kamchatka	8 new genera and 35 new species
Gilbert and Burke (1912b)	Liparid fishes from Japan	58 new species
Gilbert and Hubbs (1916)	Japanese macruroid fishes	10 new species
Hubbs (1915)	Flounders and soles collected off Japan	2 new genera and 9 new species
Hubbs (1918)	Flounders of Japan	Further observations
Jordan, et al. (1913)	Revision of the Fishes of Japan	Review of 1,230 species
Snyder (1908)	New fishes from Japan	2 new genera and 18 new species
Snyder (1909; 1911)	New fishes from Japan	5 new genera and 37 new species
Snyder (1912a; 1912b)	Shorefishes of Japan	Checklist and distribution
Other than fishes		
Agassiz and Clark (1907a, b, c; 1909)	Systematic review of echinoderms	1 new genus and 26 new species
Bartsch (1907)	Parasitic mollusk	1 new species
Bigelow (1913)	Medusae and siphonophores	6 new species
Clark (1907a)	Birds of Kamchatka	Distribution
Clark (1907b)	New species of birds	1 new genus and 18 new species
Clark (1907c, d, e, f, g)	New species of crinoids	Five papers, 58 new species
Clark (1910)	List of birds observed and collected	Distribution and life history notes
Clark (1912)	Echinoderms	Distribution and diagnosis
Dall (1913)	Diagnoses of various mollusks	1 new genus and 21 new species
Nutting (1912)	Descriptions of soft corals	2 new genera and 40 new species
Pilsbry (1911)	Barnacles of Japan and Bering Sea	6 new species
Richardson (1909)	Isopods collected	3 new genera and 28 new species

on *Albatross* collections fill an extensive list of titles, her major achievements lying in the field of marine fisheries.

For Gilbert, this expedition marked his last work aboard the *Albatross*. He became interested in the biology of Pacific salmon, *Oncorhynchus* spp., around 1909, and by 1912, to the detriment of his systematic work, he was directing most of his attention to these fishes (Dunn, 1996b). Gilbert later became the preeminent authority on Pacific salmon and an early fishery biologist.

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Literature cited

Agassiz, A., and H. L. Clark. 1907a. Hawaiian and other Pacific echini—The Cidaridae. Mem. Mus. Comp. Zool., Harv. 34(1):1–42.

_____ and _____. 1907b. Hawaiian and other Pacific echini—The Salenidae, Arbaciadae, Aspidodiadematidae, and Diadematidae. Mem. Mus. Comp. Zool., Harv. 34(1):45–140.

_____ and _____. 1907c. Preliminary report on the echini collected in 1906, from May to December, among the Aleutian Islands, in Bering Sea, and along the coasts of Kamchatka, Sakhalin, Korea, and Japan, by the U.S. Fish Commission Steamer "Albatross," in charge of Lt. Commander L. M. Garrett, U.S.N., Commanding. Bull. Mus. Comp. Zool., Harv. 51(5):108–139.

_____ and _____. 1909. Hawaiian and other Pacific echini—The Echinothuridae. Mem. Mus. Comp. Zool., Harv. 34(1): 141–204.

Anonymous. 1906a. Stanford professors to conduct expedition. Daily Palo Alto 28(40):1, col. 3 [6 March].

_____. 1906b. Zoology professors return. Daily Palo Alto 29(75): 3, col. 1 [14 Dec.].

_____. 1907. Dredging and hydrographic records of the U. S. Steamer *Albatross* for 1906. Rep. Comm. Fish. for fiscal year 1906 and spec. pap. Bur. Fish. Doc. 621, 50 p.

_____. 1968. Arthur Japy Hepburn. Who was who in America, vol. iv, 1961–1968. Marquis-who's Who, Inc., Chicago, p. 431.

Bartsch, P. 1907. A new parasitic mollusk of the genus *Eulina*. Proc. U.S. Natl. Mus. 32(1545):556.

Bigelow, H. B. 1913. Medusae and Siphonophorae collected by the U.S. Fisheries Steamer "Albatross" in the northwest Pacific, 1906. Proc. U.S. Natl. Mus. 44:1–119.

Bowers, G. M. 1906. Report of the Commissioner of Fisheries for the fiscal year ended June 30, 1906. Bur. Fish. Doc. 72, 28 p.

Burke, C. V. 1911. The relation between the coloration and bathymetrical distribution of the Cyclogasteridae. Science, N.S. 34(875): 447–453.

_____. 1930. Revision of the fishes of the family Liparidae. Bull. U.S. Natl. Mus. 150, 204 p.

Cattell, J. M. 1906. American men of science. Sci. Press, N.Y., 364 p.

Cattell, J. M., and J. Cattell (Editors). 1938. American Men of Science, 6th ed. Sci. Press, N.Y., 1,608 p.

Clark, A. H. 1907a. Characteristic Kamchatkan birds. Auk 24:278–280.

_____. 1907b. Eighteen new species and one new genus of birds from eastern Asia and the Aleutian Islands. Proc. U.S. Natl. Mus. 32(1539):467–475.

_____. 1907c. A new species of crinoid *Ptilocrinus pinnatus* from the Pacific Coast,

with a note on *Bathycrinus*. Proc. U.S. Natl. Mus. 32(1547):551–554.
_____ . 1907d. On a collection of crinoids of the genus *Eudiocrinus* from Japan, with description of a new species. Proc. U.S. Natl. Mus. 32(1551):569–574.
_____ . 1907e. Two new crinoids from the North Pacific Ocean. Proc. U.S. Natl. Mus. 32(1543):507–512.
_____ . 1907f. Descriptions of new species of recent unstalked crinoids from the coasts of Northeastern Asia. Proc. U.S. Natl. Mus. 32(1561):127–156.
_____ . 1907g. Descriptions of new species of recent unstalked crinoids from the North Pacific Ocean. Proc. U.S. Natl. Mus. 33 (1559):69–84.
_____ . 1910. The birds collected and observed during the cruise of the United States Fisheries Steamer "Albatross" in the North Pacific Ocean, and in the Bering, Okhotsk, Japan, and Eastern seas, from April to December, 1906. Proc. U.S. Natl. Mus. 38:25–74.
Clark, H. L. 1912. Hawaiian and other Pacific echini—The Pedinidae, Phymosomatidae, Stomopneustidae, Echinidae, Temnopleuridae, Strongylocentrodidae, and Echinometridae. Mem. Mus. Comp. Zool., Harv. 34(1):205–383.
Dall, W. H. 1913. Diagnoses of new shells from the Pacific Ocean. Proc. U.S. Natl. Mus. 45:587–597.
Dunn, J. R. 1996a. Charles Henry Gilbert (1859–1928), naturalist-in-charge and Chauncy Thomas, Jr. (1850–1919), commanding: conflict aboard the U.S. Fish Commission steamer *Albatross* in 1902. Mar. Fish. Rev. 58(1–2):3–16.
_____ . 1996b. Charles Henry Gilbert (1859–1928), an early fishery biologist and his contributions to knowledge of Pacific salmon (*Oncorhynchus* spp.). Rev. Fish. Sci. 4(2): 133–184.
_____ . In press. Charles Henry Gilbert (1859–1928): pioneer ichthyologist of the American West. *In* T. W. Pietsch and W. D. Anderson, Jr. (Editors), Collection building in ichthyology and herpetology. Am. Soc. Ichthyol. Herpetol., Spec. Publ. 3.
Garraty, J. A., and P. Gay (Editors). 1981. The Columbia history of the world. Harper and Row, N. Y., 1,237 p.
Gilbert, C. H. 1913. The lantern fishes of Japan. Mem. Carnegie Mus., Pittsburgh 6:67–107.
_____ and C. V. Burke. 1912a. Fishes from Bering Sea and Kamchatka. Bull. Bur. Fish. 30(1910):31–96.
_____ and _____ . 1912b. New cyclogasterid fishes from Japan. Proc. U.S. Natl. Mus. 42:351–380.
_____ . and C. L. Hubbs. 1916. Report on the Japanese macruroid fishes collected by the United States Fisheries steamer "Albatross" in 1906, with a synopsis of the genera. Proc. U.S. Natl. Mus. 51(2149):135–214.
Hamersly, L. R. 1902. The records of living officers of the U.S. Navy and Marine Corps., L. R. Hamersly Co., N.Y., 7th ed., 511 p.
Hedgpeth, J. W. 1945. The United States Fish Commission Steamer *Albatross*. Am. Neptune 5(1):5–26.
Hubbs, C. L. 1915. Flounders and soles from Japan collected by the United States Bureau of Fisheries Steamer *Albatross* in 1906. Proc. U.S. Natl. Mus. 48(2082):449–496.
_____ . 1918. Supplementary notes on flounders from Japan with remarks on the species of *Hippoglossoides*. Annot. Zool. Jpn. 9(4):369–376.
_____ . 1943. [Obituary]. John O. Snyder. Copeia 1943(4):265–266.
_____ . 1964. David Starr Jordan. Syst. Zool. 13(4):195–200.
Jordan, D. S. 1922. Days of a man. World Book Co., Yonkers-on-Hudson, N.Y, 2 vol., 710, 906 p.
_____ , S. Tanaka, and J. O. Snyder. 1913. A catalogue of the fishes of Japan. J. Coll. Sci., Imper. Univ. Tokyo, 33(1):1–497.
Malone, D. (Editor). 1933. Dictionary of American biography. Charles Scribner's Sons, N.Y., vol. 11.
Mooney, J. L. (Editor). 1991. Dictionary of American naval fighting ships. Vol. 1. Part A. Naval Hist. Cent., Dept. Navy, Washington, D.C., p. 135–138.
Myers, G. S. 1951. David Starr Jordan, ichthyologist, 1851–1931. Stanford Ichthyol. Bull. 4(1):2–6.
Nutting, C. C. 1912. Descriptions of the Alcyonaria collected by the U.S. Fisheries Steamer *Albatross*, mainly in Japanese waters, during 1906. Proc. U.S. Natl. Mus. 43: –104.
Palmer, T. S. 1948. Hubert Lyman Clark [Obituary]. Auk, N.S. 65:490.
Pietsch, T. W., and J. R. Dunn. In press. Early collection building in Puget Sound and adjacent waters: the 1880 expedition of David Starr Jordan and Charles Henry Gilbert. *In* T. W. Pietsch and W. D. Anderson, Jr. (Editors), Collection building in ichthyology and herpetology. Am. Soc. Ichthyol. Herpetol., Spec. Publ. 3.
Pilsbry, H. A. 1911. Barnacles of Japan and Bering Sea. Bull. Bur. Fish. 29:61–84.
Random House. 1987. Random House dictionary of the English language, Random House, N.Y., 2d ed., unabridged, 2,478 p.
Richardson, H. 1909. Isopods collected in the Northwest Pacific by the U. S. Bureau of Fisheries Steamer "Albatross" in 1906. Proc. U.S. Natl. Mus. 37:75–129.
Snyder, J. O. 1908. Descriptions of eighteen new species and two new genera of fishes from Japan and the Riu Kiu Islands. Proc. U.S. Natl. Mus. 35(1635):93–111.
_____ . 1909. Descriptions of new genera and species of fishes from Japan and the Riu Kiu Islands. Proc. U.S. Natl. Mus. 36(1688): 597–610.
_____ . 1911. Descriptions of new genera and species of fishes from Japan and the Riu Kiu Islands. Proc. U.S. Natl. Mus. 40(1836): 525–549.
_____ . 1912a. Japanese shore fishes collected by the United States Bureau of Fisheries Steamer "Albatross" expedition of 1906. Proc. U.S. Natl. Mus. 42:399–450.
_____ . 1912b. The fishes of Okinawa, one of the Riu Kiu Islands. Proc. U.S. Natl. Mus. 42:487–519.
Sverdrup, H. U., M. W. Johnson, and R. H. Fleming. 1942. The oceans: their physics, chemistry, and general biology. Prentice-Hall, Englewood Cliffs, N.J., 1,087 p.
Windsor, M. P. 1991. Reading the shape of nature. Univ. Chicago Press, 324 p.

Florida's Halfbeak, *Hemiramphus* spp., Bait Fishery

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Introduction

In Florida, ballyhoo, *Hemiramphus brasiliensis*, and balao, *H. balao*, form the basis of an important bait fishery (Berkeley et al., 1975; Berkeley and Houde, 1978). They are harvested with modified lampara nets, a type of surrounding net (Nedelic, 1982), and are sold as bait to anglers seeking pelagic and benthic gamefishes (e.g., billfishes and groupers). In the western Atlantic, both species are found from at least New York to Brazil (Collette, 1965), but the only significant fishery for either species is in southeastern Florida. Neither species is common north of Florida (Hildebrand and Schroeder, 1928; Hardy and Johnson, 1974; Hardy, 1978; Burgess et al., 1979), and only nominal landings are reported elsewhere, in South America (Collette, 1978), Puerto Rico (Kimmel, 1991), and the Virgin Islands (Beets and La Place, 1991).

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ABSTRACT—Two species of halfbeaks, ballyhoo, Hemiramphus brasiliensis, *and balao,* H. balao, *form the basis of a relatively small but valuable bait fishery in southeastern Florida. Halfbeak landings increased rapidly in the late 1960's but are now relatively stable (about 450,000 kg or 1 million lb annually), and their ex-vessel price is about $600,000. Fishing methods, which had changed in the late 1960's when landings increased, have changed little since the 1970's. Data from a fishery-dependent survey (1988–91) show that catch rates were highest from October to February, when catches were dominated by large ballyhoo (>200 mm or 8 inches fork length (FL)); rates were lowest from May to September, when catches contained both species in more equal numbers and the size range was greater (about 150–250 mm FL) than it was for winter landings. There was little bycatch, and only flyingfishes (Exocoetidae) and needlefishes (Belonidae) occurred consistently. Comparisons of the 1988–91 data with similar data reported from 1974 indicated that halfbeak populations have remained relatively stable.*

Ballyhoo and balao are both known as halfbeaks (Hemiramphidae; Collette et al., 1984), and because they are equally acceptable as bait, the fishery does not sort the catch by species (Berkeley et al., 1975). Still, they can be readily distinguished by the length of the pectoral fin and by their coloration when alive (Fig. 1; Berkeley et al., 1975; Collette, 1978; Böhlke and Chaplin, 1993). Both halfbeak species frequently occur together in individual fishing hauls, but ballyhoo constitutes the majority of the catch during summer and nearly all of the catch during winter (Berkeley et al., 1975). Mixed samples from throughout the year contained only 9.8% balao (Berkeley and Houde, 1978). Although other species also known as halfbeaks (e.g. *Hyporhamphus* spp.) are suitable for bait, they are not part of the fishery because they occupy different habitats and are not found in concentrated schools (Tabb and Manning, 1961; Banford and Collette, 1993; Reintjes[1]). Florida's halfbeak fishery is highly selective, and only low numbers of flyingfishes (Exocoetidae) and needlefishes (Belonidae) are consistently caught as bycatch (Berkeley et al., 1975).

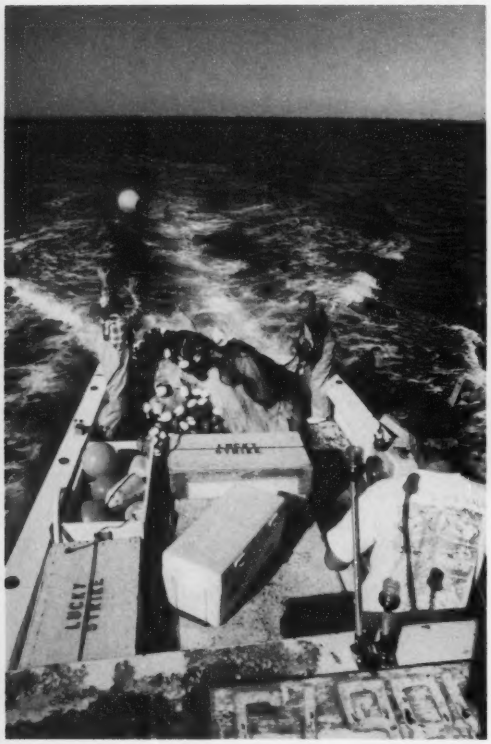
This halfbeak fishery dates back to the 1950's (Siebenaler, 1955), and annual landings increased rapidly in the late 1960's because demand for bait from marine recreational anglers had increased (Berkeley et al., 1975). Also during this time, the fishery increased its fishing power; this was accomplished by using larger nets with long ropes attached at the ends to herd the fish. This rapid increase in landings during the late 1960's was a reason for the investigations by Berkeley et al. (1975) and Berkeley and Houde (1978). They concluded that overfishing was not occurring during the early 1970's, but no assessment of the commercial fishery has been made since.

In this paper we describe landings, markets, and fishing methods for halfbeaks in Florida. We also assess the current state of the fishery based on species composition and on measurements of catch, fishing effort, and size frequencies. The data available for analysis are historical landings for 1950–94, as well as onboard observations and dockside interviews completed during 1988–91. These data are compared with historical data reported by Berkeley et al. (1975) and, in particular, are used to evaluate their prediction that exploitation of halfbeaks would increase in the future because of an expanding recreational fishery in Florida.

Materials and Methods

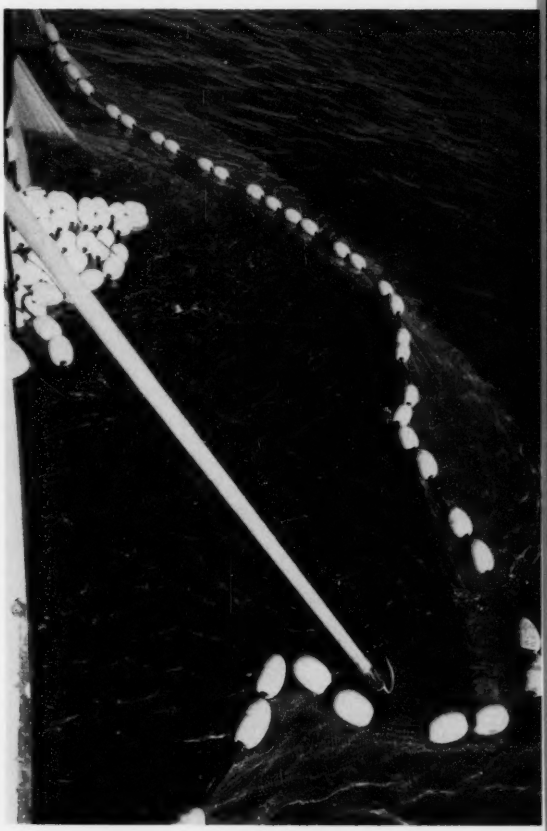
Commercial landings have been monitored in Florida since 1950 by the State of Florida in cooperation with the U.S. Fish and Wildlife Service or the

[1]Reintjes, J. W. 1979. Coastal herrings and associated species: a profile of species or groups of species, their biology, ecology, current exploitation with economic and social information. Rep. prep. for Gulf Mex. Fish. Manage. Counc., Southeast Fish. Sci. Cent., NMFS, NOAA, Beaufort, N.C., 170 p. All footnoted reports are on file at the Florida Marine Research Institute, 100 Eighth Avenue S.E., St. Petersburg, FL 33701-5095.



Above: Setting the lampara net with a marker buoy off Key Largo. When all the net and ropes are paid out the area swept can be more than a square mile.

Above: Striking the net lines during haulback to keep the surface-oriented halfbeaks from escaping.



Right: Close-up of halfbeaks in the purse of the lampara net.

Left: Halfbeaks in the purse of the lampara net. A needlefish is being removed from the net purse and released alive.

Below: Halfbeacks are immediately layered in ice and brine to preserve their condition for trolling bait.

Above: Halfbeaks are sorted by size and condition, not by species, at the fish house. The largest sizes are rigged with one or two hooks and a wire leader before being flash frozen.

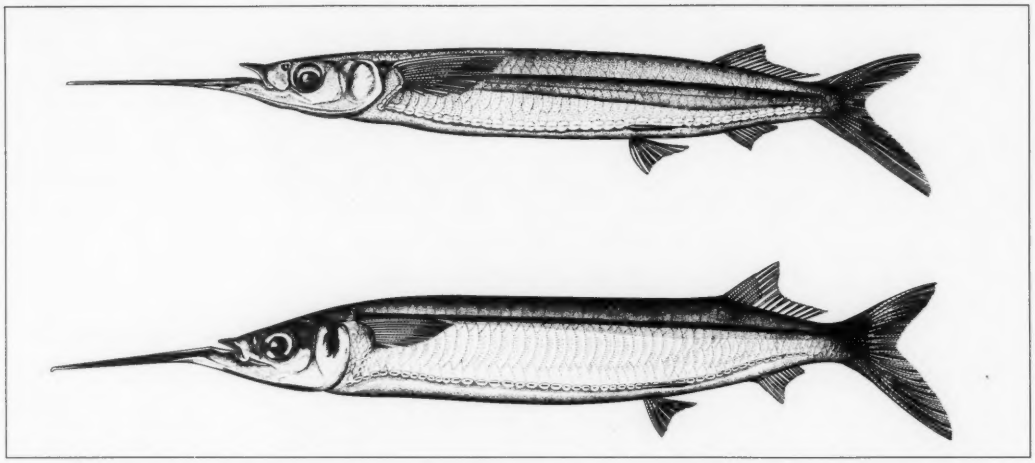


Figure 1.—*Hemiramphus balao*, balao (top); when alive the upper lobe of the caudal fin is bluish-violet with a red tip and the lower lobe is bluish. *Hemiramphus brasiliensis*, ballyhoo (bottom); when alive the upper lobe of the caudal fish is yellowish orange and the lower lobe is dusky. Illustrations provided by Bruce Collette, NMFS National Systematics Laboratory.

National Marine Fisheries Service. From 1950 to 1985, large foodfish processors were the sources of these data. In 1985, a new survey design, the Marine Fisheries Information System (MFIS), was implemented by the Florida Department of Environmental Protection (FDEP) (Muller and Murphy[2]). Florida's MFIS requires that records be kept of every wholesale transaction of marine organisms landed in Florida, so estimates of baitfish landings since 1985 are more accurate than previous estimates were.

From November 1988 to August 1991, the FDEP also completed a survey of the halfbeak fishery independent of the MFIS program. We made onboard observations (33 vessel days) and dock-side interviews (an additional 70 vessel days), which covered 26 of the 34 months in the survey period. Samples were obtained in Florida's southeastern counties, where the state's halfbeak landings are greatest, and sampling effort was apportioned between three subregions: Martin County to Palm Beach County, Broward County to Dade County, and Monroe County (Fig. 2). The survey monitored 1) species composition and abundance of target and bycatch species based on subsamples of 3–11 kg of a set's catch or up to 23 kg of a day's catch; 2) fishing effort (i.e., frequency and duration of fishing days; frequency and duration of individual hauls for onboard observations); and 3) length-frequency of ballyhoo and balao based on subsamples (100–300 fish per fishing day) of the catch. Fork lengths (FL) were measured to the nearest millimeter from the tip of the upper jaw to the fork of the tail. Individual fish from some subsamples were also weighed to the nearest 0.1 g to establish length-weight relationships. Catch rates were calculated as:

$$\text{CPUE} = C/f, \qquad (1)$$

where CPUE = catch per unit of effort,
C = catch in numbers or weight of fish
f = one vessel-day (one day of fishing by one vessel).

Catch is reported by weight unless otherwise noted. Notes regarding fishery markets and fishing methods were also recorded during 1988–91.

Results and Discussion

Landings and Markets

Annual halfbeak landings have progressed through three phases during the past four decades: 1) a phase when fishing rates and demand were low from 1950 to about 1965, 2) a phase during which the annual landings rapidly increased—1966–70, and 3) a phase when landings have been relatively high and stable since about 1971 (Fig. 3). The threefold to fourfold increase in landings during the late 1960's was attributed by Berkeley et al. (1975) to increasing demand for bait as well as to the use of larger and more efficient nets. Another threefold increase between 1985 and 1986 was largely an artifact of a change in data collection methods associated with the implementation of the Florida's MFIS program.

Since landings prior to 1986 were only from large foodfish processors, there was great potential to underestimate landings of halfbeaks and other baitfish species (Broadhead, 1951; Reintjes[1]; Johnson[3]). Annual landings during 1976–81 averaged 164,000 ±

[2]Muller, R. G., and M. D. Murphy. 1994. Report on inshore finfish trends. Rep. prep. for Fla. Mar. Fish. Comm., Dep. Environ. Prot., Fla. Mar. Res. Inst., St. Petersburg, June 13, 1994, 16 p. Prior to 1994 the FDEP was known as the Florida Department of Natural Resources.

[3]Johnson, L. E. 1974. Commercial fisheries of Florida, 1973. *In* Summary of Florida commercial marine landings, 1973. Fla. Dep. Nat. Resour., St. Petersburg, 62 p.

40,000 kg (360,000 ± 87,000 lb; mean ± standard deviation) compared to 477,000 ± 86,000 kg (1,049,000 ± 189,600 lb) during 1986–91. The change in reporting methods had the effect of tripling the landings. Based on the assumption that halfbeak landings have been relatively stable since 1971, then landings during this third and most recent phase have been maintained at about 480,000 kg (1.05 million lb) per year.

Since 1950, halfbeaks have been landed almost exclusively in southeastern counties of Florida (Fig. 3, 4). Effort was also greatest in southeastern counties, principally in Palm Beach, Dade, and Monroe counties (Fig. 4). Notable landings and effort also occurred in the Florida panhandle, but this constituted bycatch from other bait fisheries there.

The markets have changed little since being described by Siebenaler (1955) and Berkeley et al. (1975). Halfbeaks are frequently the preferred bait for marine anglers seeking billfishes (Istiophoridae), dolphin, *Coryphaena hippurus*, groupers (Serranidae), and other gamefishes (de Sylva, 1974; Nakamura and Rivas, 1974; Gentle, 1977; Jolly, 1977). The Gulf Stream is very close to Florida's southeast coast, so offshore fishing for pelagic gamefishes is very accessible. Wholesale fish houses sell halfbeaks to charter boat operators, tackle shops, and individual anglers primarily within Florida, but markets also exist out of state and abroad. Small halfbeaks are used for drift fishing for mackerels and snappers, whereas larger sizes are used more commonly for trolling for offshore, pelagic gamefishes. In the Pacific, halfbeaks (*Arrhamphus*, *Hemiramphus*, and *Hyporhamphus*) are sold as both bait and food (Collette, 1974), but to our knowledge halfbeaks landed in Florida are not sold for food.

Ex-vessel prices (e.g. those paid directly to fishermen) varied principally in relation to fish size-class and seasonal availability. Halfbeaks were usually sold by the piece (instead of by weight), which differs from marketing of other baitfishes. Conversions between numbers and weight in this study used an

Figure 2.—Florida's coastal counties and areas of major fishing activity for halfbeaks surveyed in 1988–91. Counties mentioned in the text or Figure 3 are identified; Monroe County includes all of the Florida Keys. Resolution for identifying fishing zones while at sea was 5' lat. × 5' long.

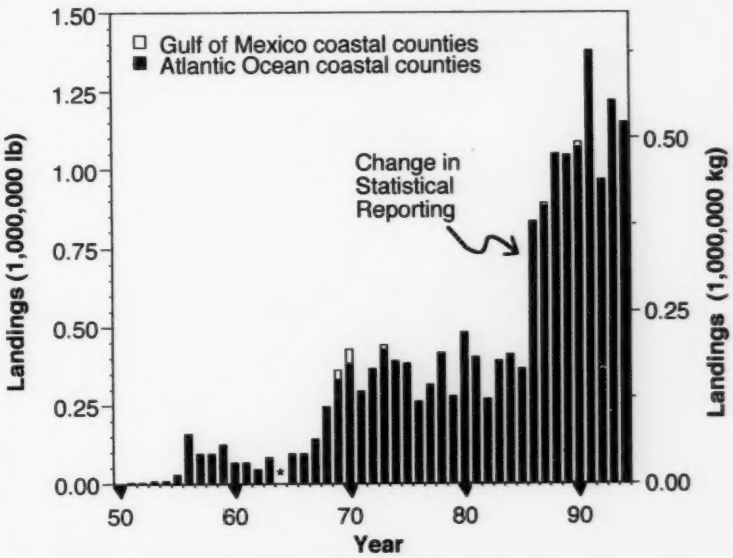


Figure 3.—Florida's annual landings of halfbeaks (ballyhoo and balao combined), 1950–1994. Data for the years 1950–85 were collected from commercial fish processors by the State of Florida. Data for 1986–94 were based on Florida's MFIS. Atlantic coastal counties include Monroe and all others east; Gulf coastal counties include Collier and all others to the west (Fig. 2). Landings for Gulf coast counties equal zero for 16 of 45 years, but Gulf coast landings are frequently not visible here unless greater than or equal to 5,000 lb because of the range of the ordinate (left axis=lb, right axis=kg). The annual landing for 1964, 917,000 lb(*), is anomalous and cannot be explained.

average value of 13.7 fish/kg (6.2 halfbeaks/lb), which was based on unsorted samples from the fishery collected year-round (n = 3524). Some of each day's catch was sold as fresh bait, which was not sorted by size and consistently commanded a high price of $0.15/fish (about $2.00/kg or $0.90/lb) during 1989–90. Except during busy sportfishing seasons, when demand for fresh bait was high, a majority of halfbeaks were sorted by size and then frozen. Representative size categories[4] were small (85 g or <3 ounce [oz]), medium (85–127 g or 3–4.5 oz,), large (127–156 g or 4.5–5.5 oz), horse (156–184 g or 5.5–6.5 oz), and jumbo (184+ g or 6.5+ oz). The ex-vessel prices ranged from $0.02–0.03/fish for small sizes to $0.12–0.20/fish for horse or jumbo sizes. In addition, some very small (about 1 oz) or damaged fish were typically sold at a bulk price, which was consistently $0.33/kg ($0.15/lb). The average value for halfbeaks landed in 1989 was $1.43/kg ($0.65/lb) based on ex-vessel transactions in Palm Beach and Dade counties. The 1990 price was estimated as $1.19/kg ($0.54/lb), but this was not significantly different between years based on 95% confidence intervals of $1.06–1.80/kg ($0.48–0.82/lb) in 1989 and $0.79–1.58/kg ($0.36–0.72/lb) in 1990.

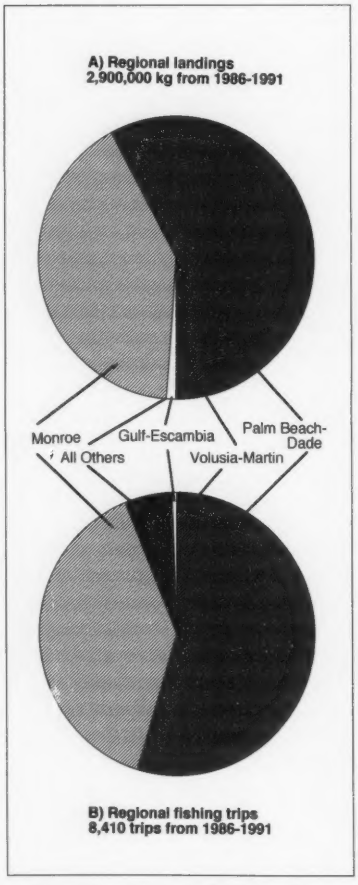


Figure 4.—Regional halfbeak (ballyhoo and balao combined) landings (A) and number of fishing trips (B) by county or groups of counties. See Figure 2 for county locations. Data are for 1986–1991 from Florida's MFIS.

Ex-vessel prices during 1989–90 were considerably higher than values reported by Berkeley et al. (1975) but were similar after adjustment for inflation. In 1974, ex-vessel prices were $0.03–0.08/fish compared to the average range of $0.03–0.15/fish in 1989–90. Retail prices in 1974 were $1.75–3.00/dozen ($0.15–0.25/fish) compared to $4.50–5.00/dozen (0.38–0.42/fish and as high as $1.00/fish for the larger sizes) in 1989–90. Inflation alone would cause an ex-vessel price of $0.05 in 1974 to rise to $0.12 in 1989,[5] whereas the retail value would rise from $0.20 in 1974 to $0.48 in 1989.

Compared with Florida's other baitfish species, halfbeak landings were relatively small but the value was quite high. In 1989–90, annual ex-vessel value of the commercial fishery was about $600,000, based on landings of 0.477 million kg (1.05 million lb) multiplied by the estimated prices above. Relative to other important baitfishes in Florida, only one-fourth as many halfbeaks as thread herring, *Opisthonema oglinum*, were landed, and only half as many halfbeaks as Spanish sardines, *Sardinella aurita*, were landed in 1989–90 (comparisons done by weight[2]). However, the 1989–90 value of these two clupeid species was only $0.22–0.33/kg ($0.10–0.15/lb), so the annual ex-vessel value of Atlantic thread herring was only about $500,000 and Spanish sardine was only about $350,000.

Fishing Methods

During 1988–91, ten vessels were operating in southeast Florida, each with a captain and two or three crew members. These boats ranged from 7.3 m to 10.4 m (24–34 ft) long and were powered by 250–350 horsepower engines. Their holding capacities were limited to six–eight 0.45 m^3 (16-ft^3) boxes; each box could hold about 230 kg (500 lb) or about 2,000–3,000 individual fish. Fish were captured with modified lampara nets, a type of surrounding net (Nedelec, 1982). The nets measured 410–640 m (450–750 yd) in length and had wings that hung 1.2–2.4 m (4–8 ft) deep; the wings are cut to fish only the upper water column because halfbeaks are found near the surface in association with reef habitat. A pocket 10.0- to 12.1-m (33–40 ft) deep was sewn in at one end of the net. The mesh used ranged from 1.9 cm to 3.8 cm (0.75–1.5 in) stretch mesh. These nets were modified from a typical lampara design, by having purse lines in the pocket. An additional 550–3,660 m (600–4,000 yd) of line was attached to the net to increase the area swept when fishing the net.

Ballyhoo and balao school in coastal waters near and between reef structures (Tabb and Manning, 1961; Stark and Davis, 1966), where they can be observed near the surface. An average day of fishing on the vessels surveyed occurred during daylight and lasted slightly more than seven hours. Shallow inshore waters were searched out to 9 km (5 n.mi.) from shore and to a depth of about 18 m (60 ft). The primary fishing grounds identified during our survey were the nearshore patch reefs in the Palm Beach and Biscayne

[4]Up to seven categories could be used at different fish houses. Berkeley et al. (1975) reported four categories: <185 mm, 185–235 mm, 235–265 mm, and >265 mm fork length. Those categories are similar to these reported here and correspond approximately to <50 g, 50–110 g, 110–160 g, and >160 g, based on length-weight conversions from Berkeley and Houde (1978).

[5]Inflation is adjusted for a price difference of 2.42 between 1974 and 1989, using the Economic Report of the President, January 1993, Table b–3: Implicit price deflator for gross domestic product, 1959–1992.

Bay regions and the offshore reefs of the Biscayne Bay and Florida Keys regions (Fig. 2). Fishing depths were greater in Palm Beach County (about 9–15 m or 30–50 ft), where the continental shelf is narrower, than in Dade or Monroe counties (<9 m or 30 ft). More area was searched during April–September when fish were relatively scarce, but in general only one or two 5' × 5' (minutes of latitude and longitude) grids were searched during a single day. The grids searched were farther south during the winter and more to the north during summer, which presumably followed the seasonal movements of the halfbeaks.

Once a school was located, the net and lines were set to surround it. The lines skimmed the water surface as the net was drawn in, and less line was required when the fish were more closely aggregated. Fish were loaded onto the boat with a dip net and immediately placed in layers of crushed ice and brine. Setting and hauling lasted about one hour, and three hauls were made per fishing day on average. The mean number of hauls made per day was lowest in summer and highest in autumn (January to March = 2.9, April to June = 3.0, July to September = 2.3, and October to December = 3.5, based on onboard observations only).

Only subtle changes in fishing methods have been made recently. The size, storage capacity, and horsepower of the vessels observed by Berkeley et al. (1975) were slightly less than those observed during 1988–91. Larger vessels can hold more fish, but because many fish are sold as fresh bait, daily catch is closely associated with daily demand at the fish houses and bait shops. The nylon nets used during 1988–91 were similar to those reported by Berkeley et al. (1975) but were much larger than the cotton nets described by Siebenaler (1955). Nets used in the early 1970's were 370–600 m (400–650 yd) long, whereas nets used in the 1950's were only 180–275 m (200–300 yd) long. The use of extra line to herd the fish during the fishing operation also began in the 1960's. Thus, the most notable changes in halfbeak fishing technology occurred during the 1960's.

Species Composition

The percentage composition of ballyhoo and balao changed seasonally (Fig. 5), similar to the changes reported by Berkeley et al. (1975). Pure catches of ballyhoo occurred (45 of 89 observed hauls, 50.5%), principally in winter months. Ballyhoo and balao occurred together in 35 hauls (39.3%), principally during spring–autumn. Pure catches of balao occurred only twice (2.2%). The remaining seven observed hauls (7.8%) caught neither species because of entangled nets, difficult weather conditions, or fish becoming spooked and escaping.

The fishing gear and methods used were highly selective for fish in the upper water column, so bycatch was generally low. The only species frequently collected besides halfbeaks were flyingfishes (Exocoetidae: *Cypselurus* and *Parexocoetus*) and needlefishes (Belonidae: *Ablennes* and *Tylosaurus*). Flyingfishes occurred most frequently during spring and summer (maximum of 16.6%, by numbers, in any observed haul). Flyingfishes could be sold as bait and were therefore not always discarded. Needlefishes appeared sporadically (maximum of 5.1%, by numbers, in any observed haul). Other species occurred only rarely and did not include gamefish or foodfish species.

Abundance

Catch rates of ballyhoo peaked during winter, whereas catch rates of balao peaked during summer (Fig. 6). Ballyhoo catches during October–March ranged from 360 to 1,720 kg/d (800–3,800 lb/d), but balao catches rarely exceeded 450 kg/d (1,000 lb/d) at any time of the year. These seasonal variations in catch rates appear to be affected by both the absolute abundance and the availability of fish. Winter catches were higher in part because age-0 fish grow fast enough to become exploited (see below). Fish behavior is also a factor, because halfbeaks are more aggregated and in larger schools during winter on these fishing grounds. Interspecific differences in abundance are not understood but we are now (i.e. 1996) collecting data that may clarify the extent

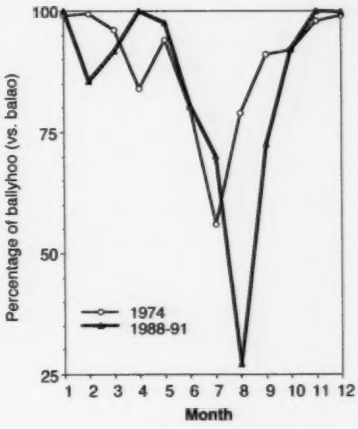


Figure 5.—Percentage composition of halfbeaks, ballyhoo vs. balao by month, in the southeast Florida lampara net fishery. Data source is based on onboard observations of 8,504 fish from 80 different hauls made on 32 days, 1988–1991. Background data for 1974 is from Berkeley et al. (1975).

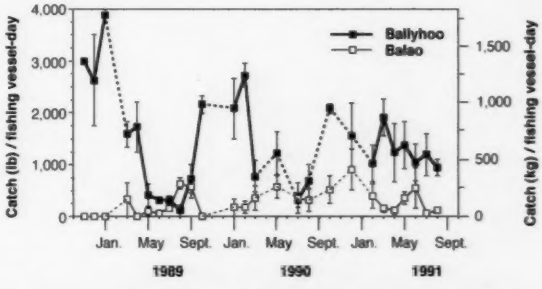


Figure 6.—Mean daily catch/vessel-day for 26 months sampled from November 1988 to August 1991 (left axis=lb, right axis=kg). Data depicts catch rates of ballyhoo and balao separately; dashed lines indicate sampling across nonconsecutive months. Error bars are ± 1 s.e.

of habitat specificity and seasonal migration patterns by each halfbeak species.

Catch rates for both halfbeak species combined declined in summer, which also was the seasonal trend observed in 1974 (Fig. 7). Monthly catch rates during 1988–91 were, however, consistently higher than they were during 1974. Daily catch rates in winter, a peak fishing season, appeared to be limited principally by vessel capacity, and the slightly larger vessels used in recent years have allowed for larger winter landings. It is even possible that demand for halfbeaks rose slightly in the late 1980's (Fig. 3), and because no additional boats entered the fishery, each boat made bigger catches. Berkeley et al. (1975) noted that 11 fishing vessels operated in the halfbeak fishery in 1974, and each vessel carried only four boxes for holding fish, whereas during 1988–91, 10 vessels operated and each usually carried six to eight boxes. By late spring or during the summer, "fresh" bait supplies occasionally become saturated and frozen fish are stockpiled, so boats carry fewer boxes to match the daily demand. If a haul exceeds the holding capacity of the vessel the fish are released, and this creates small differences between actual catch and landed catch values reported. Such occasions are rare, however, and we observed this only once when an estimated 1.5 boxes of fish were released live after 3 boxes were packed during a March fishing trip.

Size Composition

The size ranges of the two halfbeak species overlapped but ballyhoo were typically larger than balao (Fig. 8). In this survey, ballyhoo ranged from 108 mm to 313 mm FL (209 ± 26.3; mean ± s.d.; n = 20,307) and balao ranged from 131 mm to 273 mm (194 ± 24.3; n = 6,791). After truncating the extreme tails of the length distributions, about 95% of the ballyhoo harvested were 150–260 mm (5.9–10.2 in) long and 95% of balao captured were 145–240 mm (5.7–9.5 in) long. Ballyhoo also weighed more, on average, than balao (76.8 g vs. 61.2 g), based on year-round samples from the fishery (n = 3,524).

At least two size classes were evident for both species (Fig. 8). Small, age-0 fish were evident and often dominant in July, about four months after spawning begins (Berkeley and Houde, 1978). A descriptive growth model, based on analysis of scale-determined ages, suggests that ballyhoo grows fairly fast during its first year and that both species reach 209–231 mm (8.2–9.1 inches) FL at annulus I (Berkeley and Houde, 1978). Berkeley and Houde also compared growth rates from the laboratory and field and concluded that the size-frequency of age-0 fish in the fishery is probably biased until October or November, because only the larger and faster-growing fish are harvested during the summer and early autumn. The mean size of ballyhoo at the time annulus II was formed was 264 mm (10.4 in) FL (Berkeley and Houde, 1978), a size well represented in the fishery during the winter months of 1988–91. Because few ballyhoo live longer than two years and few balao live longer than one year, the fishery exploited all age classes of both species (Berkeley et al., 1975).

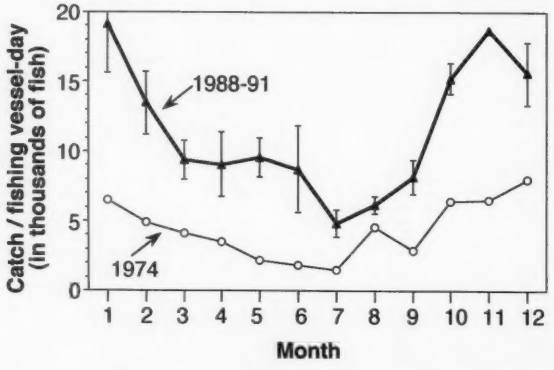


Figure 7.—Comparison of monthly catch rates of halfbeaks (ballyhoo and balao combined) caught during 1988–91 with those caught during 1974, as reported in Berkeley et al. (1975). Data for 1988–91 were converted to numbers of fish per trip based on the average value of 13.7 fish/kg (6.2 fish/lb). There are no standard error bars for November because we surveyed only one vessel fishing during this month in all years. All other months (1988–90) are represented by >4 fishing-vessel days. Measures of variance were not reported in Berkeley et al. (1975), and their catch rates for January were combined from data collected in 1974 and 1975.

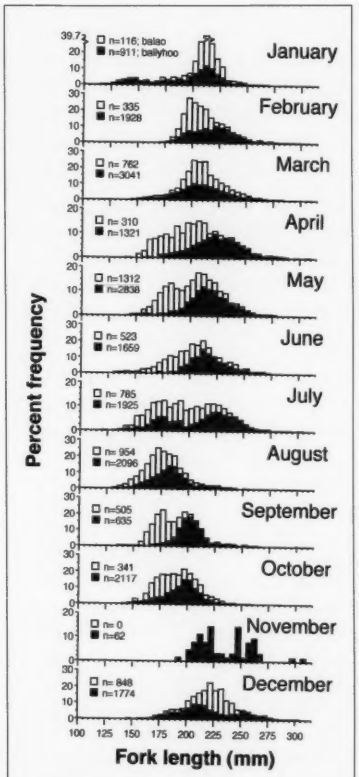


Figure 8.—Monthly length-frequency of ballyhoo and balao, based on pooled data for 1988–91 and plotted as a stacked histogram. N = number of fish measured. The ordinate has a maximum of 20% or 30% for graphical clarity.

Management Implications

The higher catch rate observed for 1988–91 is the most compelling evidence that the fishery did not overexploit halfbeak populations during the 1970's and 1980's. The absence of changes in species composition also supports this conclusion, but this argument is less tractable because the fishery does not distinguish between species. The general length-frequency of fish was also similar between 1974 and 1988–91, and age-0 fish were observed in all years examined, suggesting that no major year-class failure occurred during this 3-year period.

Estimates of recreational fishing effort indicate that general demand for bait probably increased little during the 1980's. In Monroe County specifically, the average number of headboats was relatively constant from 1981 to 1992 (Bohnsack et al., 1994). The estimated total number of recreational fishing trips made along Florida's Atlantic coast also did not increase during the 1980's (1980 = 10.5 million trips; 1985 = 12.5 million trips; 1990 = 8.8 million trips; Holliday, 1984; NMFS, 1986; Van Voorhees et al., 1992). However, it may be that demand for halfbeaks has grown while demand for other baitfishes has been level or declined. During the late 1980's some fish processing plants switched to flash freezing and vacuum packing halfbeaks, and this has helped maintain the quality of halfbeak bait (which is particularly important for trolling the whole fish). If so, then this would increase consumer demand, and it may explain the apparent increase in halfbeak landings between 1986 and 1994 (1991 peak = 0.626 million kg).

Continued monitoring of the commercial halfbeak fishery through Florida's MFIS program and occasional special surveys are cost-effective for tracking halfbeak populations. This approach, however, does not monitor halfbeaks harvested by anglers, who use cast nets, and occasionally small hooks, to catch fish that are attracted with oatmeal or chum. The numbers of ballyhoo harvested directly for bait by anglers (including those on charter and party boats) has not been well documented, but Bohnsack et al. (1994) suggested that private anglers in Monroe County harvested 5,000–35,000 halfbeaks (about 400–2,500 kg) annually during the 1980's.

Recent changes in fishing regulations, accomplished through Florida's constitutional "net ban" referendum (enacted July 1995), should affect the proportions of halfbeak harvested between Palm Beach and Monroe counties. The surrounding nets used in the ballyhoo fishery are now prohibited within 1 or 3 miles of shore, on the Atlantic and Gulf coasts, respectively; because the continental shelf adjacent to Palm Beach county is relatively narrow, most of the fishing grounds there have been eliminated. Monroe County (which includes the Florida Keys) has a large number of reefs beyond these limits. Monroe County's proportion of the total landings for Florida has already increased from 35% in 1986 to 52% in 1991 and to 75% in 1994, but this occurred principally because Dade County's landings have declined proportionally. If Palm Beach landings decline as well, then Monroe County's proportion of landings will increase further. Increases in halfbeak landings in Monroe County represent both a geographic shift and absolute growth of halfbeak landings, because total Florida landings have also increased from 380,300 kg (836,600 lb) in 1986 to 523,000 kg (1,150,700 lb) in 1994. More location-specific information about the fishery is being collected, and this will assist us in understanding the current and potential changes in the fishery.

Acknowledgments

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Literature Cited

Banford, H. M., and B. B. Collette. 1993. *Hyporhamphus meeki*, a new species of halfbeak (Teleostei: Hemiramphidae) from the Atlantic and gulf coasts of the United States. Proc. Biol. Soc. Wash. 106(2):369–384.

Beets, J., and J. A. LaPlace. 1991. Virgin Islands baitfish survey: October to December 1986. Proc. Gulf Caribb. Fish. Inst. 40:55–63.

Berkeley, S. A., and E. D. Houde. 1978. Biology of two exploited species of halfbeaks, *Hemiramphus brasiliensis* and *H. balao* from southeast Florida. Bull. Mar. Sci. 28(4): 624–644.

_____, _____, and F. Williams. 1975. Fishery and biology of ballyhoo on the southeast Florida coast. Univ. Miami Sea Grant Program, Spec. Rep. 4, 15 p.

Böhlke, J. E., and C. G. Chaplin. 1993. Fishes of the Bahamas and adjacent tropical waters. 2nd ed. Univ. Tex. Press, Austin, 771 p.

Bohnsack, J. A., D. E. Harper, and D. B. McClellan. 1994. Fisheries trends from Monroe County, Florida. Bull. Mar. Sci. 54(3):982–1018.

Broadhead, G. C. 1951. The organization of the Florida Marine Fisheries Statistical System. Proc. Gulf Caribb. Fish. Inst. 3:114–117.

Burgess, G. H., G. W. Link, Jr., and S. W. Ross. 1979. Additional marine fishes new or rare to Carolina waters. Northeast Gulf Sci. 3(2):74–87.

Collette, B. B. 1965. Hemiramphidae (Pisces, Synentognathi) from tropical west Africa. Atlantide Rep. 8:217–235. Dan. Sci. Press, Ltd., Copenhagen

_____. 1974. The garfishes (Hemiramphidae) of Australia and New Zealand. Rec. Aust. Mus. 29(2):11–105.

_____. 1978. Hemiramphidae. *In* W. Fischer (Editor), FAO species identification sheets for fishery purposes, Western Central Atlantic (Fishing Area 31). Vol. II. Food Agric. Organ., U.N., Rome (unpagin.).

_____, G. E. McGowen, N. V. Parin, and S. Mito. 1984. Beloniformes: development and relationships. *In* H. G. Moser (Editor in chief), Ontogeny and systematics of fishes, p. 335–354. Am. Soc. Ichthyol. Herpetol., Spec. Publ. 1.

de Sylva, D. P. 1974. A review of the world sport fishery for billfishes (Istiophoridae and Xiphiidae). *In* Richard S. Shomura and Francis Williams (Editors), Proceedings of the International Billfish Symposium Kailva-Kona, Hawaii, 9–12 August 1972. Part 2, Review and contributed papers, p. 12–33. U.S. Dep. Commer., NOAA Tech. Rep. NMFS-SSRF-675.

Gentle, E. C. 1977. The charterboat sport fishery of Dade County, Florida, March 1976 to February 1977. Univ. Miami, Coral Gables, 162 p.

Hardy, J. D., Jr. 1978. Development of fishes of the mid-Atlantic bight, An atlas of egg, larval and juvenile stages. Vol. 2, Anguillidae through Syngnathidae. U.S. Dep. Inter., Fish Wild. Serv., Biol. Serv. Program, Rep. FWS/OBS–78/12:127–138.

_____ and R. K. Johnson. 1974. Descriptions of halfbeak larvae and juveniles from Chesa-

peake Bay (Pisces: Hemiramphidae). Chesapeake Sci. 15:241–246.
Hildebrand, S. F., and W. C. Schroeder. 1928. Fishes of Chesapeake Bay. Bull. U.S. Bur. Fish. XLIII(Pt. 1):152–154.
Holliday, M. C. 1984. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1979(revised)–1980. US. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Curr. Fish. Stat. 8322.
Jolley, J. W., Jr. 1977. The biology and fishery of Atlantic sailfish, *Istiophorus platypterus*, from southeast Florida. Fla. Mar. Res. Publ. 28, 31 p.
Kimmel, J. J. 1991. A fisheries dependant [sic] survey of baitfishes in Puerto Rico. Proc. Gulf Caribb. Fish. Inst. 40:64–81.
Nakamura, E. L., and L. R. Rivas. 1974. An analysis of the sportfishery for billfishes in the northeastern Gulf of Mexico during 1971. *In* Richard S. Shomura and Francis Williams (Editors), Proceedings of the International Billfish Symposium Kailva-Kona, Hawaii, 9–12 August 1972. Part 2, Review and contributed papers, p. 269–289. U.S. Dep. Commer., NOAA Tech. Rep. NMFS-SSRF-675.U.S. Dep. Commer., NOAA Tech. Rep. NMFS-SSRF-675.
NMFS. 1986. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1985. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Curr. Fish. Stat. 8327.
Nedelec, C. 1982. Definition and classification of fishing gear categories. Food Agric. Organ., U.N., Rome, FAO Fish. Tech. Pap. 222, 51 p.
Siebenaler, J. B. 1955. Commercial fishing gear and fishing methods in Florida. Fla. Board Conserv., Mar. Lab. Tech. Ser. 13, 45 p.
Stark, W. A., Jr., and W. P. Davis. 1966. Night habits of fishes of Alligator Reef, Florida. Ichthyol. Aquarium J. 38(4):313–356.
Tabb, D. C., and R. B. Manning. 1961. A checklist of the flora and fauna of northern Florida Bay and adjacent brackish waters of the Florida mainland collected during the period July, 1957 through September, 1960. Bull. Mar. Sci. 11(4):552–649.
Van Voorhees, D. A., J. F. Witzig, M. F. Osborn, M. C. Holliday, and R. J. Essig. 1992. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1990–1991. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Curr. Fish. Stat. 9204.

NMFS Celebrates 125th Anniversary

February 9, 1996, marked the 125th anniversary of the creation in 1871 of the U.S. Commission of Fish and Fisheries, predecessor of NOAA's National Marine Fisheries Service and the Nation's first Federal conservation agency. "Then, as today, Federal fisheries science was at the forefront of its field and noteworthy for its excellence," noted NMFS Director Rolland A. Schmitten, in announcing the agency's quasquicentennial observance.

To further the observance, the agency produced a commemorative 1996 calendar, a review of the agency's history entitled "Baird's Legacy: The History and Accomplishments of NOAA's National Marine Fisheries Service," and a special 125th anniversary logo (by Barbara Comstock of the SEFSC Pascagoula Laboratory) and poster (by Katherine Zecca of the Alaska Fisheries Science Center). In addition, another lengthier historical book is in progress.

Many agency facilities are also hosting special open-house celebrations, and NMFS has also helped develop and cosponsor two Smithsonian Institution exhibits: The "Ocean Planet" exhibit is making a 5-year tour of U.S. museums showing the human use of ocean resources, and "Science at Sea" displays the work of the *Albatross*, the first vessel expressly designed for marine science research, and which conducted fisheries and oceanographic research from 1882 to 1922.

In addition, a 125th anniversary school science project is underway, which includes the provision of 5,000 folders of resource materials for science teachers at schools nationwide as well as special programs for selected schools. Historical information is also provided via an electronic home page on the Internet/World-Wide-Web (http://www.wh.whoi.edu/history.html?).

The founder and first Commissioner of the U.S. Commission of Fish and Fisheries was Spencer F. Baird who took on the job, at no increase in salary, in addition to his myriad duties as Assistant Secretary of the Smithsonian Institution. Baird's early interests seemed to involve birds, and his reputation as an ornithologist is first rate. Just when he first visited the seashore and when he became interested in fishes is not clear. However, we do know that his first published article on fishes, titled "The sea-serpent in Norway" (Baird, 1846) was published only 3 years after his first ornithological article, coauthored with his bird-loving brother William M. Baird, "Descriptions of two species, supposed to be new, of the genus Tyrannula Swainson, found in Cumberland County, Pennsylvania," in 1843 (Baird and Baird, 1843). It (the sea-serpent article) was only his seventh formally published paper. His second work on fishes, published in 1851, was simply titled "Fishes" in the "Outlines of General Zoology," and reprinted from "Iconographic Encyclopaedia of Science, Literature, and Art," published by Charles Rudolph Garrigue, a New York publisher. And while this one was not an original article of his own, it was part of a highly important German work, "Bilder Atlas zum Conversations Lexicon," which Baird translated, partially rewrote, and edited and which played a key role in advancing his scientific stature and career (Rivinus and Youssef, 1992). When that was published, Allard (1978) reported that Baird was "one of the best known men in American science." Baird's third article dealing with fishes, coauthored with Charles Girard in 1853, was "Descriptions of new species of fishes from the River Zuni," published in the Proceedings of the Academy of Natural Science of Philadelphia, vi:387–390.

George Brown Goode (1883) compiled and published a 377-page bibliography of Baird's writings. Complete through 1882, it lists 1,063 titles, many of which, as Goode noted, contained "important original matter." Interestingly enough, the largest category of publications was on fishes, with 431 citations, followed by 109 relating to exploration and travel; only 73 related to mammals, 80 to birds, and 43 to reptiles. In introducing that bibliography, Goode (1883) provided a brief sketch of Baird's life which is herewith reprinted, followed by a tribute to Baird rendered by several colleagues at the unveiling of an official memorial to him in Woods Hole, Mass., in 1903.

References

Allard, D. C., Jr. 1978. Spencer Fullerton Baird and the U.S. Fish Commission. Arno Press, N.Y., 424 p.

Baird, S. F. 1846. The sea-serpent of Norway. Lit. Rec. J. Linnaean Soc. Pa. Coll. ii(5):106–107.

_____. 1851. Iconographic encyclopaedia of science, literature, and art. Systematically arranged by J. G. Heck, translated from the German with additions and edited by Spencer F. Baird, A. M., M. D., Professor of Natural Sciences in Dickinson College, Carlisle, Pa. Rudolph Garrigue, Publ., N.Y., 4 vol.

_____. 1851. Fishes. *In* S. F. Baird (Editor), Outlines of general zoology, p. 197–247. Repr. from Icongraphic encyclopaedia of science, literature, and art. Rudolph Garrigue, Publ., N.Y.

_____ and W. M. Baird. 1843. Descriptions of two species, supposed to be new, of the genus Tyrannula Swainson, found in Cumberland County, Pennsylvania. Proc. Acad. Nat. Sci. Phila. i:283–285.

_____ and C. Girard. 1853. Fishes [of the Zuni River]. *In* Sitgreaves' report of an expedition down the Zuni and Colorado Rivers, p. 148–152. Wash.

Dall, W. H. 1915. Spencer Fullerton Baird, a biography. J. B. Lippincott Co., Phila., 462 p.

Goode, G. B. 1883. Bibliographies of American naturalists. I. The published writings of Spencer Fullerton Baird, 1843–1882. Dep. Inter., Bull. U.S. Natl. Mus. 20, 377 p.

Rivinus, E. F., and E. M. Youssef. 1992. Spencer Baird of the Smithsonian. Smithson. Inst. Press, Wash., D.C., 228 p.

Biographical Sketch of Spencer Fullerton Baird[1]

GEORGE BROWN GOODE

I. Outline of His Public Career.

Spencer Fullerton Baird was born in Reading, Pennsylvania, February 3, 1823. In 1834 he was sent to a Quaker boarding-school kept by Dr. McGraw, at Port Deposit, Maryland, and the year following to the Reading Grammar School. In 1836 he entered Dickinson College, and was graduated at the age of seventeen. After leaving college, his time for several years was devoted to studies in general natural history, to long pedestrian excursions for the purpose of observing animals and plants and collecting specimens, and to the organization of a private cabinet of natural history, which a few years later became the nucleus of the museum of the Smithsonian Institution. During this period he published a number of original papers on natural history. He also read medicine with Dr. Middleton Goldsmith, attending a winter course of lectures at the College of Physicians and Surgeons, in New York, in 1842. His medical course was never formally completed, although in 1848 he received the degree of M. D., *honoris causa*, from the Philadelphia Medical College. In 1845 he was chosen professor of natural history in Dickinson College, and in 1846 his duties and emoluments were increased by election to the chair of natural history and chemistry in the same institution. In 1848 he declined a call to the professorship of natural science in the University of Vermont. In 1849 he undertook his first extensive literary work, translating and editing the text for the "Iconographic Encyclopedia," an English version of Heck's *Bilder Atlas*, published in connection with Brockhaus's *Conversations Lexikon*.

July 5, 1850, he accepted the position of Assistant Secretary of the Smithsonian Institution, and October 3, at the age of twenty-seven years, he entered upon his life work in connection with that foundation—"the increase and diffusion of useful knowledge among men."* His work as an officer of the Institution will be discussed more fully below. It was constant and arduous, but did not prevent the publication of many original memoirs, among the most elaborate of which are the "Catalogue of North American Serpents" (1853); the "Birds of North America" (1858); the "Mammals of North America" (1859); the "Review of North American Birds" (1864–'66); the "Geographical Distribution of North American Birds" (1865); the "History of North American Birds," in connection with Thomas M. Brewer and Robert Ridgway (1874), and the preparation of numerous official reports. From 1870 to 1878 he was scientific editor of the periodicals published by Harper Brothers, of New York, and the author of their yearly cyclopedia of science, entitled "The Annual Record of Science and Industry." In 1871 he was appointed by President Grant to the position of United States Commissioner of Fish and Fisheries, an unsalaried office, to the duties of which he has for eleven years devoted a large portion of his time. In 1876 he served as one of the Government Board of Commissioners to the International Exhibition at Philadelphia, and was also a member of the international jury. In 1877 he was present, as advisory counsel, at the session of the Halifax Fishery Commission.

In May, 1878, after the death of Professor Henry, he was, by the unanimous vote of the Regents, elected Secretary of the Smithsonian Institution.

II. Honors and Dignities.

Professor Baird, in 1856, received the degree of Doctor of Physical Science from Dickinson College, and in 1875 that of Doctor of Laws from Columbian University. He was, in 1878, awarded the silver medal of the Acclimatization Society of Melbourne; in 1879 the gold medal of the *Societe d'Acclimatation* of France, and in 1880 the Erster Ehrenpreiz of the *Internationale Fischerei Ausstellung* at Berlin, the gift of the Emperor of Germany. In 1875 he received from the King of Norway and Sweden the decoration of "Knight of the Royal Norwegian Order of St. Olaf." He was one of the early members of the National Academy of Sciences, and ever since the organization has been a member of its council. In 1850 and 1851 he served as permanent secretary of the American Association for the Advancement of Science, and since 1878 has been one of the trustees of the Corcoran Gallery of Art in Washington. He has been president of the Cosmos Club, and for many years a trustee of Columbian University. Among his honorary relations to numerous scientific societies of the United States and other countries are included those of foreign membership in the Linnaean Society of London, and the Zoological Society of London, honorary membership in the Linnaean Society of New South Wales, and corresponding membership in the *K. K. Zoologisch-botanische Gesellschaft*, Vienna; the *Sociedad de Geographia*, Lisbon; the New Zealand Institute; the *Koninklijke Natuurkundige Vereeniging in Nederlandsch Indie*, Batavia; the *Magyar Tudomanyos Akademia*, Buda-Pesth; the *Societe Nationale des Sciences Naturelles*, Chergourg; the *Academia Germanica Naturae Curiosorum*, Jena; the *Naturforschende Gesellschaft*, Halle; the *Naturhistorische Gesellschaft*, Nuremburg; the Geographical Society of Quebec; the Historical Society of New York; the *Deutsche Fischerei Verein*, Berlin.

The nomenclature of zoology contains many memorials of his connection with its history. A partial enumeration shows that over twenty-five species and one genus of fishes bear his name.

A post-office in Shasta County, California, located near the McCloud River Salmon Hatching Station of the United States Fish Commission, was named "Baird" by the Postmaster-General in 1877.

[1]From Bull. U.S. Natl. Mus. 30:v–xiii (1883).

*The motto of the Smithsonian Institution and of its founder, James Smithson.

III. Ancestry and Development of Character.

His ancestry upon the one side was English, upon the other Scotch and German. His paternal grandfather was Samuel Baird, of Pottstown, Pa., a surveyor by profession, whose wife was Rebecca Potts. The Bairds were from Scotland, while the Potts family removed from Germany to Pennsylvania at the close of the seventeenth century. His great grandfather on the mother's side was the Rev. Elihu Spencer, of Trenton, one of the war preachers of the Revolution, whose patriotic eloquence was so influential that a price was set on his head by the British Government; his daughter married William M. Biddle, a banker, of an English family for many generations established in Pennsylvania, and identified with the banking interests of Philadelphia. Samuel Baird, the father of the subject of this sketch, established himself as a lawyer at Reading, Pennsylvania, and died when his son was ten years old. He was a man of fine culture, a strong thinker, a close observer, and a lover of nature and of out-of-door pursuits. His traits were inherited by his children, but especially by his sons Spencer and William. The latter, who was the elder, was the first to begin collecting specimens, and as early as 1836 had in hand a collection of the game-birds of Cumberland County. His brother soon became his companion in this pursuit, and six years later they published conjointly a paper entitled "Descriptions of two species, supposed to be new, of the Genus Tyrranula Swainson, found in Cumberland County, Pennsylvania."

There are still in the museum at Washington specimens of birds prepared by these boys forty-five years ago by a simple process of evisceration, followed by stuffing the body-cavities full of cotton and arsenical soap. The brother, William M. Baird, diverged into other paths, and at the time of his death in 1872 was United States collector of internal revenue at Reading.

The inheritance of a love of nature and a taste for scientific classification, the companionship of a brother similarly gifted, tended to the development of the young naturalist, and a still more important element was the encouragement of a judicious mother by whom he was permitted to devote the five years immediately following his graduation to his own devices and plans instead of being pushed at once into a profession. In 1841, at the age of eighteen, we find him making an ornithological excursion through the mountains of Pennsylvania, walking 400 miles in twenty-one days, the last day 60 miles between daylight and rest. The following year he walked more than 2,200 miles. His fine physique and consequent capacity for work are doubtless due in part to his outdoor life during these years.

IV. Early Friendships and Their Influence.

An important stimulus to the efforts of this young naturalist was the friendship which he formed as early as 1838 with [John James] Audubon, with whom he was for many years in correspondence, and who, in 1842, gave to him the greater part of his collection of birds, including most of his types of new species. Young Baird contributed many facts and specimens for the "History of North American Quadrupeds" at that time in preparation [by Audubon], as well as to [Audubon's] "Ornithological Biography," and was only prevented by ill health from accompanying Audubon as his secretary on his six months' expedition to the Yellowstone in 1840. In those days were formed many of the friendships and partnerships with scientific men which influenced his after life. Among his early correspondents were George N. Lawrence (1841), John Cassin (1843), John G. Morris (1843), Thomas M. Brewer (1845), and S. S. Haldeman (1845). In 1847 he met [Louis] Agassiz, then just arrived from Switzerland in company with Desor and Girard. At this time or a year later was projected the work of Agassiz and Baird on "The Fresh-water Fishes of the United States," which was, however, never published, although a number of illustrations and some pages of text were elaborated. In 1843 he translated Ehrenberg's "Corals of the Red Sea" for J. D. Dana, who was then preparing his reports for the United States exploring expedition. As early as 1846 we find him engaged in the preparation of a synonymy of North American birds, and visiting Boston to consult the libraries of Amos Binney and the Boston Society of Natural History for works not possessed by the Philadelphia Academy of Natural Sciences. This material was utilized twelve years later in the "Birds of North America."

As professor of natural history in Dickinson College he taught the seniors in physiology, the sophomores in geometry, and the freshmen in zoology. He found time, however, to carry on the works begun in previous years, and to make in summer extended collecting expeditions: To the Adirondacks in 1847; to Ohio in 1848, to collect, in company with Dr. Kirtland, from the original localities of the types, the fishes described by him in his work on the fishes of Ohio; to the mountains of Virginia in 1849; and to Lake Champlain and Lake Ontario in 1850.

When in 1850, upon the urgent recommendation of the late George P. Marsh, he was elected an officer of the Smithsonian Institution, he brought with him to Washington methods of work, developed in his personal experience, which became at once the methods of the establishment, and are still employed in many of its departments.

V. Analysis of His Work and Its Results.

There may be noted in the career of Professor Baird several distinct phases of activity, namely, (1) a period of twenty-six years, 1843–1869, occupied in laborious investigation and voluminous publication upon the vertebrate fauna of North America; (2) forty years of continuous contribution to scientific literature, of which at least ten were devoted to scientific editorship; (3) five years, 1845–1850, devoted to educational work; (4) forty years, 1842–1883, devoted to the encouragement and promotion of scientific enterprises, and the development of new workers among the young men with whom he was brought into contact; (5) thirty-three years, 1850–1883, devoted to administrative work as an officer of the Smithsonian Institution, and in charge of the scientific collections of the government—twenty-eight as principal executive officer and five as Secretary and re-

sponsible head; (6) twelve years as head of the Fish Commission, a philanthropic labor for the increase of the food-supply of the world, and incidentally in promoting the interests of biological and physical investigation of the waters.

VI. Contributions to Science and Scientific Literature.

The extent of Professor Baird's contributions to science and scientific literature may be at least partially comprehended by an examination of the succeeding pages of the present work. The list of his writings is complete to the end of the year 1882, and contains 1,063 titles. Of this number 775 are brief notices and critical reviews contributed to the "Annual Record of Science and Industry," while under his editorial charge, 31 are reports relating to the work of the Smithsonian Institution, 7 are reports upon the American fisheries, 25 are schedules and circulars officially issued, and 25 are volumes or papers edited. Out of the remaining 200 the majority are formal contributions to scientific literature.

It seems scarcely necessary to remark that most of the official reports above referred to, as well as many of the brief articles in the "Annual Record," contain important original matter.

Nineteen of the descriptive papers were published conjointly with Charles Girard, while the most elaborate work, "The Birds of North America," was prepared in its first edition with the aid of Messrs. Cassin and Lawrence, and in its second with that of Messrs. Brewer and Ridgway.

Of the total number of papers enumerated in the list 73 relate to mammals, 80 to birds, 43 to reptiles, 431 to fishes, 61 to invertebrates (these being chiefly reviews), 16 to plants, 88 to geographical distribution, 46 to geology, mineralogy, and paleontology, 45 to anthropology, 31 to industry and art, 109 to exploration and travel.

While the number of new species described does not necessarily afford any clew [sic] to the value of the work accomplished, it may not be uninteresting to refer to it as an indication of the pioneer work which it was necessary to do even in so prominent a group as the vertebrates. I note among mammals 49, birds 70, reptiles 186, fishes 56. Forty-nine of 220, or nearly one-fourth, of the mammals discussed in the "Mammals of North America," were there described for the first time. In the catalogue of serpents not more than 60 per cent. [sic] had been named, and in preparation for studying the specimens, each was carefully ticketed with its locality, and then the 2,000 or more individuals were thrown indiscriminately into one great pile, and the work of sorting them out by resemblances was begun. Not the least valuable have been the numerous accurate figures of North American vertebrates, prepared under Professor Baird's supervision. These include representatives of 170 species of mammals and 160 species of reptiles, besides still many hundreds of birds.

VII. Educational and Administrative Works.

Passing to the consideration of the influence of Professor Baird on the encouragement of scientific enterprise, it seems scarcely necessary to call attention to the manner in which this influence has been exerted, since the relation of the Smithsonian Institution to scientific exploration, particularly in the lines of natural history and ethnology, is a part of the scientific history of the country, and since this department of the work of the Institution was always from its inception under the direction of the assistant secretary. The first grant made by the Institution for scientific exploration and field research was in 1848 to Spencer F. Baird, of Carlisle, for the exploration of the bone caves and the local natural history of Southeastern Pennsylvania.

From the start the Department of Explorations was under his charge; and in his reports to the Secretary, published year by year in the annual report of the Institution, may be found the only systematic record of government explorations which has ever been prepared. From 1850 to 1860 several extensive government expeditions were sent to the western territories, and it became the duty of Professor Baird to enlist the sympathies of the commanders of these expeditions in the objects of the Institution, to supply them with all the appliances for collecting, as well as with instructions for their use, and also in most cases to organize the natural history parties, nominate the collectors, employ and supervise the artists in preparing the plates, and in many instances to edit the zoological portions of the reports.

The fitting out of such expeditions was only a small part of the work; from the beginning until now there have been numerous private collectors, deriving their materials, their literature, and, to a considerable extent, their enthusiasm from the Smithsonian Institution, and consequently in correspondence with its officers. The Smithsonian "Instructions to Collectors," which has passed through several large editions, as well as numerous circulars written with a similar purpose, were prepared by Professor Baird in connection with this department of his work.

As a result of this extensive work of organization, a large number of young men have been trained as collectors and observers, and among them not a few have become eminent in various departments of science.

In addition to this special branch of his work, the assistant secretary had, from the start, the charge of certain departments of the routine work of the Institution; the system of international exchanges, for instance, which had ever been one of the leading objects of the Smithsonian Institution, was organized by him in its details. His first task, after entering upon his duties, was to distribute the second volume of the "Smithsonian Contributions to Knowledge." Already in connection with his private enterprises he had developed a somewhat extensive system of exchanges with European and American correspondents, and the methods thus established were expanded for the wider needs of the Institution. The main duty of the assistant secretary, however, was the development of the natural history collections. As has already been indicated, the private collection which he brought with him to Washington formed the nucleus of the Smithsonian museum. The only specimens in possession of the Institution at the time of his arrival were a few boxes of minerals and plants. The collections of the Wilkes Exploring Expedition,

which constitute the legal foundation of the National Museum of the United States, were at that time under the charge of the National Institute; and, although by the act of incorporation the Smithsonian Institution was the legal custodian of the national cabinet of curiosities, it was not until 1857 that the Regents finally accepted the trust and the National Museum was definitely placed under the control of the Smithsonian Institution and transferred to its building. Until this time Congress had granted no funds for the support of the Smithsonian cabinets, and the collections had been acquired and cared for at the expense of the endowment fund. They had, however, become so large and important in 1857 that the so-called "National Collection" at that time acquired were small in comparison.

The National Museum then had a double origin. Its actual although not its legal nucleus was the collection gathered in the Smithsonian building prior to 1857. Its methods of administration, which were in fact the very same that had been developed by Professor Baird in Carlisle as early as 1845, are those which are still in use, and which have stood the test of thirty years without any necessity for their modification becoming apparent. In the bibliography below [Goode, 1883] is reprinted from the fifth annual report of the Smithsonian Institution, now exceedingly rare, a report by the assistant secretary in charge of the natural history department for the year 1850, which enumerates the specimens belonging to the Museum on January 1, 1851, including a full account of his own deposit.

Having thus almost from the very outset been associated with Professor Henry in the organization of the Smithsonian Institution, his course since his accession to the secretaryship has been a consistent continuation of that which had for twenty-eight years been adopted.

VIII. Work as Commissioner of Fisheries.

The work of the Fish Commission, in one of its aspects, may perhaps be regarded as the most prominent of the present efforts of the government in aid of aggressive biological research.

On the 9th of February, 1874 [sic], Congress passed a joint resolution which authorized the appointment of a Commissioner of Fish and Fisheries. The duties of the Commissioner were thus defined: "To prosecute investigations on the subject (of the diminution of valuable fishes) with the view of ascertaining whether any and what diminution in the number of food-fishes of the coast and the lakes of the United States has taken place; and, if so, to what causes the same is due; and also whether any and what protective, prohibitory, or precautionary measures should be adopted in the premises, and to report upon the same to Congress."

The resolution establishing the office of Commissioner of Fisheries required that the person to be appointed should be a civil officer of the government, of proved scientific and practical acquaintance with the fishes of the coast, to serve without additional salary. The choice was thus practically limited to a single man. Professor Baird, at that time assistant secretary of the Smithsonian Institution, was appointed and at once entering upon his duties soon developed a systematic scheme of investigation.

The Fish Commission now fills a place tenfold more extensive and useful than at first. Its work is naturally divided into three sections:

1. The systematic investigation of the waters of the United States and the biological and physical problems which they present. The scientific studies of the Commission are based upon a liberal and philosophical interpretation of the law. In making his original plans the Commissioner insisted that to study only the food-fishes would be of little importance, and that useful conclusions must needs rest upon a broad foundation of investigations purely scientific in character. The life history of species of economic value should be understood from beginning to end, but no less requisite is it to know the histories of the animals and plants upon which they feed or upon which their food is nourished; the histories of their enemies and friends, and the friends and foes of their enemies and friends, as well as the currents, temperatures, and other physical phenomena of the waters in relation to migration, reproduction, and growth. A necessary accompaniment to this division is the amassing of material for research to be stored in the national and other museums for future use.

2. The investigation of the methods of fisheries, past and present, and the statistics of production and commerce of fishery products. Man being one of the chief destroyers of fish, his influence upon their abundance must be studied. Fishery methods and apparatus must be examined and compared with those of other lands, that the use of those which threaten the destruction of useful fishes may be discouraged, and that those which are inefficient may be replaced by others more serviceable. Statistics of industry and trade must be secured for the use of Congress in making treaties or imposing tariffs, to show to producers the best markets, and to consumers where and with what their needs may be supplied.

3. The introduction and multiplication of useful food-fishes throughout the country, especially in waters under the jurisdiction of the general government, or those common to several States, none of which might feel willing to make expenditures for the benefit of the others. This work, which was not contemplated when the Commission was established, was first undertaken at the instance of the American Fish Cultural Association, whose representatives induced Congress to make a special appropriation for the purpose.

IX. Epilogue.

Comment upon the facts presented in this biographical sketch seems to be unnecessary. Future historians of American science will be better able than are we to estimate justly the value of the contributions to scientific literature which are enumerated in the bibliography; but no one not living in the present can form an accurate idea of the personal influence of a leader upon his associates, and upon the progress of thought in his special department, nor can such an influence as this well be set down in words. This influence is apparently due not only to extraordinary skill in organization, to great power of application and concentration of thought constantly applied, and to a philosophical and comprehensive mind, but to an entire and self-sacrificing devotion to the interests of his own work and that of others.

THE "BAIRD MEMORIAL"

In mid 1903, during the annual meeting of the American Fisheries Society, AFS members, U.S. Fish Commission (USFC) staff, and other interested persons gathered at Woods Hole, Mass., to dedicate a permanent memorial to Spencer F. Baird, founder of the U.S. Fish Commission. President of the AFS that year was the USFC Commissioner George M. Bowers. Speakers were Chicago attorney E. W. Blatchford; W. K. Brooks, a professor at Johns Hopkins University, Baltimore, Md., who had conducted research at the Commission's Beaufort Laboratory; and, very briefly, the noted fish culturists Frank N. Clark of Michigan and Livingston Stone of Vermont. The following record of the dedication ceremony appeared as a two-part article in *The Fishing Gazette*, 22 and 29 August 1903.

The American Fisheries Society meeting was called to order July 22, 1903, at 2:30 p.m., on the grounds of the United States Fish Commission at Woods Hole, Mass., for the purpose of conducting memorial exercises in honor of Spencer Fullerton Baird.

The meeting was called to order by the President, George M. Bowers, who spoke as follows:

"At a former meeting of the American Fisheries Society a resolution was passed suggesting the erection of a tablet to the memory of Prof. Spencer F. Baird, an appropriate tribute and recognition of the distinguished labors in behalf of fisheries and biological science. A committee was appointed to raise the necessary funds and has faithfully performed its duty, so that we are here today to dedicate this memorial. It is certainly especially fitting that such a tablet should be erected at Woods Hole, the scene of so many of his scientific achievements, where his life's labors ended."

Following a brief invocation, the presentation continued.

President Bowers—The tablet will now be unveiled by Miss Rose McDonald, Miss Eleanor Bowers and Mr. Vinal N. Edwards.

The tablet presented by the Society was then unveiled. The President then read the inscription on the tablet as follows:

"In memory of Spencer Fullerton Baird, U.S. Commissioner of Fisheries 1871–1887, the American Fisheries Society places this tablet in appreciation of his inestimable services to Ichthyology, Pisciculture and the Fisheries. 1902."

President Bowers—It gives me pleasure to present to you Mr. E. W. Blatchford, who has been selected to deliver one of the addresses on this occasion.

Address of
E. W. Blatchford

Mr. President and members of the United States Commission of Fish and Fisheries and of the American Fisheries Society, faculty and students of the Marine Biological School, ladies and gentlemen: It is three years since I had the honor of urging upon the American Fisheries Society, in response to resolutions presented by Dr. Smith, the erection of a monument to the memory of Professor Baird, and the appropriateness that such memorial should be located here, the scene of much of his most successful and distinguished scientific labor. The proposition met with an enthusiastic response, both from your society and afterwards from the United States Commission, which promptly assigned this most eligible point. A committee in charge of the work was appointed by the society with Dr. Hugh M. Smith as chairman. Under his thoughtful and efficient direction the plans were perfected, a granite boulder of worthy dimensions was found on the adjacent island of Nonnamesset, was brought and placed in position, and a commemorative tablet of bronze was designed and executed. To unveil this tablet we do meet here at this hour. Your committee would express their regret that the prosecution of important scientific investigations by the Government in the western Pacific Ocean prevents the presence with us of our honored chairman, Dr. Smith. He sends me his regrets that he cannot unite with us on this day, which was, on his suggestion, postponed a year that we might have with us the members of the American Fisheries Society.

It is due to this audience, as it is to myself, that I state that a friendship with Prof. Baird of some thirty years was the

argument that induced me to take part in these exercises. The time allotted will admit of but a slight sketch of some of this valuable life. For data in its preparation I am indebted largely to the memorial tribute of his esteemed friend and associate, George Brown Goode, and to other sources as well.

Spencer Fullerton Baird was born in Reading, Pennsylvania, February 3, 1823. His ancestry on the one side was English, upon the other Scotch and German. His great grandfather on the mother's side was the Reverend Elihu Spencer, of Trenton, New Jersey, one of the war preachers of the Revolution, whose patriotic eloquence was so influential that a price was set on his head by the British Government. His father, Samuel Baird, who died when his son was ten years old, was a lawyer, a man of fine culture, a strong thinker, a close observer, and a lover of nature and of out-of-door pursuits. His traits were inherited by his children, but especially by his sons Spencer and William. The early education of Spencer was obtained at a Quaker boarding school at Port Deposit, Maryland, and at the Reading grammar school. In 1836 he entered Dickinson College, and was graduated at the age of seventeen. After leaving college, his time for several years was devoted to studies in general natural history, to long pedestrian excursions for the purpose of observing animals and plants and collecting specimens and to the organization of a private cabinet of natural history, which a few years later became the nucleus of the museum of the Smithsonian Institution. The inheritance of a love of nature and a taste for scientific classification, the companionship of a brother similarly gifted, tended to the development of the young naturalist, and a still more important element was the encouragement of a judicious mother by whom he was permitted to devote the five years immediately following his graduation to his own plans instead of being pushed at once into a profession. In 1841, at the age of eighteen, we find him making an ornithological excursion through the mountains of Pennsylvania, walking 400 miles in twenty-one days, the last 60 miles between daylight and rest. The following year he walked more than 2,200 miles. His fine physique and consequent capacity for work were doubtless due in part to his outdoor life during these years.

During this period he published a number of original papers on natural history. He also read medicine with a physician, attending a winter course of lectures at the College of Physicians and Surgeons in New York in 1842. His medical course was never formally completed, although in 1848 he received the degree of M.D., honoris causa, from the Philadelphia Medical College. In 1845 he was chosen "Professor of Natural History" in Dickinson College, which I find included the strange combination of "teaching the seniors in physiology, the sophomores in geometry, and the freshmen in zoology." His summers, however, were devoted to extended collecting expeditions—to the Adirondacks in 1847, to Ohio in 1848 to collect, in company with Dr. Kirtland, from the original localities of the types, the fishes described by him in his work on the fishes of Ohio, to the mountains of Virginia in 1849, and to Lakes Champlain and Ontario in 1850. In 1848 he declined a call to the professorship of natural science in the University of Vermont. In 1849 he undertook his first extensive literary work, translating and editing the text for the "Iconographic Encyclopedia," an English version of Heck's Bilder-Atlas published in connection with Brockhaus' Conversations-Lexikon.

A large field now opened before Professor Baird. On the urgent recommendation of the late George P. Marsh he was elected an officer of the Smithsonian, and on July 5, 1850, he accepted the position of assistant secretary of this institution, and on October 3, at the age of twenty-seven years, he entered upon his life work, pursued with indefatigable earnestness in connection with that beneficent national foundation. Its aim, as well as the key to the consecrated life of Professor Baird, is found in the motto of the institution and of its generous founder, James Smithson, "The increase and diffusion of useful knowledge among men." He brought with him to Washington methods of work developed in his own personal experience, which became at once the methods of the establishment. His scientific enterprise, however, was not unknown to the Smithsonian authorities, for we find that "the first grant made by the institution for scientific exploration and field research was in 1848 to Spencer F. Baird, of Carlisle, for the exploration of the bone caves and the local natural history of southeastern Pennsylvania." The thorough preparation and influential position in the world of science with which he entered upon these duties is evidenced by the friendships and partnerships he had during these early years already formed with leading naturalists on both continents, and the system of exchanges which in connection with his private enterprises he had developed with European and American correspondents. I have spoken of his connection with the eminent Dr. Kirtland in 1848. Ten years before that he had met Audubon and had felt the stimulus of his friendship, proved by Audubon's gift to his young friend in 1842 of the greater part of his collection of birds, and most of his types of new species. It was a keen disappointment to both that the illness of Baird prevented his accompanying Audubon as his secretary on his six months' trip to the Yellowstone in 1840. The early correspondence with such men as George N. Lawrence in 1841; with Cassin and John G. Morris in 1843, and with Brewer, and Haldeman in 1845 influenced Baird's after life. In 1847 he met Agassiz just arrived from Switzerland in company with Desor and Girard. How natural was the sympathy immediately developed between these congenial spirits is shown by the fact that within a year was projected the work of Agassiz and Baird on "The Freshwater Fishes of the United States." In 1843 he translated Ehrenberg's "Corals of the Red Sea" for the Prof. J. D. Dana, then preparing his reports for the United States Exploring Expedition, and in 1846 we find him in Boston consulting the libraries of Amos Binney and the Boston Society of Natural Sciences for preparing a "Synonymy of North American Birds."

Before this audience I need not dwell upon the signal influence of Professor

Baird in the encouragement of scientific enterprise from the time of his entering upon his official connection with the Smithsonian. The Department of Explorations from the start was under his charge. What that meant of laborious but enthusiastic work in organization of the extensive government expeditions, selecting commanders, nominating collectors, employing artists, and often editing the zoological portions of the reports, with the immense home and foreign correspondence involved, can only be estimated by an examination of the voluminous and systematic records of the institution. Thus have I gathered what seems a very meager sketch of the development of the life of Prof. Baird up to the time when in 1874 the office of Commissioner of Fish and Fisheries was established, to which office he promptly received the appointment. And what a wealth of knowledge, study, observation, administrative ability he brought to this most attractive field of research and public utility. There is no need that time be given here to detail the work of the United States Fish Commission. With its three-fold object you are familiar—first, the systematic investigation of the waters of the United States and the biological and physical problems which they present; second, "the investigation of the methods of fisheries, and the statistics of production and commerce of fishery products; and third, the introduction and multiplication of useful food fishes throughout the country." This annual gathering bespeaks the intelligent interest which from all portions of our country centers in this beneficent work. It remains that I briefly sketch a few traits of the noble man who organized this work and in whose memory we are met at this hour. Though these have been often dwelt upon by those in intimate official connection with him, the occasion demands a few reminiscences, in which you will pardon some allusions of a personal character.

It was in connection with the organization and administration of the Chicago Academy of Sciences about 1868 that my acquaintance with Professor Baird first began. I had become interested in him through his papers on birds, but still more through my friend, his eminent predecessor in the Smithsonian, Professor Henry; and also through the glowing enconiums of Professor Agassiz, both of whom had visited our city. The first impression made when I came in contact with him was of a man of indefatigable activity of body and mind. This impression was correct, and subsequent acquaintance, whether in the Smithsonian or in his own home in Washington, or in his summer quarters at Woods Hole, when surely recreation should have been secured, corroborated that first estimate. What a proof of tireless devotion is given in the bibliography of his publications prepared by Dr. Goode, issued in 1883. This list embraces 1,063 titles of which 73 relate to mammals, 80 to birds, 43 to reptiles, 431 to fishes, 61 to invertebrates, 16 to plants, 88 to geographical distribution, 46 to geology, mineralogy and paleontology, 45 to anthropology, 31 to industry and art, and 109 to exploration and travel. I know of no such evidence of tireless devotion in existence, where you consider the number of contributions, the breadth of research involved, the thoroughness of treatment, and also take account of the constant burdens carried by the writer in administration of three great organizations—the Smithsonian Institution, its ward, the National Museum, and the Fish Commission. And to such a life did the world bear abundant testimony. Almost every civilized country paid him honor. Honorary degrees came to him from the universities and colleges of our own land, and I know of no prominent scientific society but what claimed him in its honorary membership. All realized indebtedness due to one who was a perennial spring of enthusiasm in departments of scientific effort so varied. Mention should be made of testimonials bestowed by foreign countries. In 1875 he received the decoration of Knight of the Royal Norwegian Order of St. Olaf from the King of Norway and Sweden. In 1878 he was awarded the silver medal of the Acclimatization Society of Melbourne, and in 1879 the gold medal of the Société d'Acclimatation of France. He bore corresponding, or honorary, memberships in zoological or botanical societies in London, New South Wales, Vienna, Lisbon, New Zealand, Batavia, Budapesth, Cherbourg, Jena, Halle, Nuremberg, Quebec, Berlin.

It was a touching tribute to Professor Baird's services that was received soon after his death from Yize, the most northerly island of the Japanese Archipelago, in the form of a little volume beautifully printed upon silk, containing his portrait and the story of his character. Perhaps Germany more than any other country recognized the importance of his services to fish culture. In 1880 at the first great International Fishery Exhibition held in Berlin, the magnificent silver trophy which was the first prize was awarded to him by the Emperor William. It has been stated that while Professor Baird's portrait hung over the entrance to the American section at Berlin, the Kammerherr von Behr, the president of the German Fishery Union, the most influential fishery organization in the world, never passed under it without taking off his hat in honor of the "first fish-culturist of the world," as he delighted to call him. The nomenclature of zoology contains many memorials of his connection with its history. A partial enumeration shows that over twenty-five species and one genus of fishes bear his name, and that not less than forty species have been named in his honor. These will for all time be monuments to his memory as lasting as the institutions which he founded.

To his friends who know him best and miss him most it seems pleasanter to dwell upon the recognition which his labors received than upon the labors themselves, his devotion to which so shortened his life.

Time forbids any analysis of the character of Professor Baird. Indeed the occasion, and my personal relations to him to whose memory we consecrate this hour favors no critical sentiment. I may briefly present a few characteristics which memory bring before me. And first there stands out his modesty, always impressive whether in personal contact or in his writings. Although constantly before the public he seemed never to care for public recognition. Throughout a long life given to the public service, I find but one instance where he was induced to take the platform in a

public place. This occurred a few months before his death, when Harvard University conferred upon him the degree of LL.D., as an "eminent promoter of science."

No man was more easily approached than Professor Baird. His reception of young persons, especially those with an inclination to natural history, was particularly charming, at once relieving them from embarrassment and captivating them by his unassuming manners, his geniality, and frankness. I wish there were time to present instances of these traits. They irradiate through his whole life. His unfailing geniality was proverbial. These characteristics secured for him the favorable consideration of congressional committees when presenting his requests for money to be used in the expanding work of the Fish Commission of the National Museum.

May I mention one other very marked trait in Professor Baird? His aversion to personal controversy, so decided that under no circumstances could he be drawn into one, and this when as a pioneer in scientific research his views always frankly expressed called out frequent criticism. One who knew him well writes: "One of his striking characteristics was that he would never quarrel, and never have anything to do with the quarrels of others. He was always for peace."

But the earthly end of this noble life drew on. Nature could not longer endure the strain which for nigh half a century unremitting, unselfish devotion to the promotion of science had made upon mind and body. For many months before the end, Professor Baird knew that the closing shadows were gathering. The public realized it when with startled sorrow early in 1887 at his request the Regents of the Smithsonian authorized the appointment of Professors Langley and Goode as assistants. The aid came too late. In the early summer he returned to Woods Hole, vainly hoping its pure air and cool breezes might still permit some participation in his loved Fish Commission work, and this satisfaction was to some extent granted him. His life was now restricted, and with many results of his life work about him, he calmly awaited the highest summons. In this period of weakness it was his pleasure, placed in a wheel-chair, to be moved around the pier, past the vessels he had built for research, and through the laboratory where many were at work in biological investigations. For everyone he had words of good cheer, well knowing they were words of farewell. The end came when after a brief period of unconsciousness he breathed his last on August 19, 1887.

Of all the tributes to his character none was more eloquent than one at the funeral services, which were held in the Fish Commission building. The simple burial service had been read, when the clergyman recited these words from the Sermon on the Mount: "Blessed are the merciful, for they shall obtain mercy. Blessed are the pure in heart, for they shall see God. Blessed are the peacemakers, for they shall be called the children of God."

During the reading of the paper the writer said: "I also say, at that very time Dr. Kirtland discovered the bird which now bears his name on the western shores of our own Lake Michigan.

"One evening I was sitting with Prof. Baird at his house in Washington, and I said, 'A friend in Chicago has had a motto placed over his mantle which has interested me very much, and I would like to see one over yours.' 'What is it?' he said, and I suggested the motto, 'The increase and diffusion of useful knowledge among men.'"

At the end of his paper, the writer said:

"His thoughts were with his work up to the last. In the morning one of his nearest aids and assistants, one who is now honored by all for the work that he is doing for this Commission, called upon him, as was his habit, in the early morning, and Prof. Baird said to him, 'I wish you would set a trap off Butler's Point. I think there are grounds there that may bring in something.' He left immediately and went about the work, and when he was getting the poles set to which he was attaching his net, as he looked over at the commission, he noticed that the flag had been placed at half mast, and he came home and found his chief then lying in the present office, dead."

Address of
W. K. Brooks

One must be an ornithologist, and an ichthyologist, and an explorer of the deep sea, and he must have in his mind the whole history of these great departments of biological science, if he is to speak of the contributions to these varied aspects of natural knowledge which we owe to his earnestness and industry and scientific insight.

One must search the records of the Smithsonian before he can venture to speak of the results of his long service to this institution as its secretary, and one must know its later history, in order to understand the permanent influence of his administration.

One must know how the collection which he brought together overflowed its crowded cellars and dimly lighted corridors, until he laid the foundation of the National Museum, and established it so firmly, and made such wise and skilful provision for its growth and improvement that it has quickly outgrown the generous limits of the home which he provided, and must soon be cared for in a still more stately and commodious building.

One must know the history of the National Academy of Sciences, to understand his part in the organization of this body of eminent men to be the advisors of our government on those affairs of state which call for the experience and technical knowledge and judgment of scientific experts.

No one who has not seen the work of the United States Fish Commission, in all its details, upon land and sea; its work of exploration in our streams and lakes, and along our sea-coast, and in the depths of ocean; its success in protecting and preserving and increasing the aquatic supply of human food; the contribution it has made to the peace of nations by protecting and defending our fisheries from international complication; its work of biological research in the laboratory and the museum—no one who has not seen and studied and reflected upon all this until he has come to understand it in all its interrelations with economics, and biology, and education and statesmanship, and intellec-

tual development, can venture to speak of this, the greatest of Professor Baird's creations.

Finally, no one who did not enjoy the life-long confidence and friendship of Professor Baird can take the liberty of telling of the sweetness and grand simplicity of his nature, of his quick and lively sympathies, of the magnanimity and disinterestedness and directness of thought which were shown in his every word and act. I knew him but little, and only near the end of his days, and while I was able to perceive how much these qualities, which so endeared him to all who knew him better, contributed to the success of his great undertakings, I have no right to talk of him from this personal standpoint.

You are all as familiar with his great achievements as I am. You know that he increased the efficiency of the Smithsonian Institution for the diffusion of knowledge. You know that he conceived the plan for a National Museum, and put it into execution. You know that he was one of the founders of the National Academy of Science, and that he was prominent in its councils. You know that this laboratory is his work and that he was the father of the Fish Commission, and that all its diversified lines of activity were clearly and definitely outlined by him and that they have become the accepted standard and model for similar undertakings the world over.

I should have found it a pleasant task to have made some one of these great achievements the subject of this address. I should have found profit and instruction in discovering the obstacles and difficulties which Professor Baird overcame, and in studying the tact and wisdom with which he planned and executed all his undertakings. It would have been a congenial occupation to have seen and mastered all the ramifications of the activity of one of these great creations of his genius; its growth from the foundations which he laid, along the lines which he so clearly foresaw and provided for; but I regret that it has not been in my power to handle any of the topics today; for the high honor of the opportunity to speak of the work of this great naturalist and many-sided man of science came to me only a few days ago, far from books of reference and means of inquiry, at a little laboratory which I had set up at a remote point, in order to complete, in a cool climate, a biological research for which I had gathered the material, in the early part of the summer, at the new laboratory of the United States Fish Commission at Beaufort, North Carolina.

After the completion of the central station at Wood's Hole, it was Prof. Baird's plan, announced many years ago, to promote the study of marine biology by the erection of laboratories at points upon our sea coast selected for their natural advantages; and I cannot too highly commend the wisdom which has led his successors to select Beaufort for the first step in the movement to give effect to his intention.

The new laboratory, which was opened last summer, is a carefully and skilfully planned and beautifully constructed building; and it is, in all things, a model and an object lesson, for I have never seen a more convenient and comfortable and attractive laboratory.

It stands alone upon a little island close to the town of Beaufort, and it is within easy reach of the fauna of the North Carolina seacoast, in all its wonderful richness and variety and inexhaustible abundance. It is thoroughly equipped with everything that the investigator can ask, and with all the comforts that he needs to make his life a pleasant one in the southern summer.

I cannot describe to one who has not lived and worked in this laboratory the care and thought and intelligent foresight that have been shown by those who have had it in their charge to put the plans of Professor Baird into practice, and to foresee and provide for all the needs of the investigator.

I have myself spent many summers at Beaufort with scanty facilities, and under many hardships and privations, and I had come to consider them the necessary incidents of summer work in the waters of North Carolina, so that I was lost in amazement to find myself surrounded with comforts and conveniences at the new laboratory, as I reflected that the investigator who works there in future years will have no though of Beaufort, except as a place where every advantage is to be enjoyed without any discomfort.

They will owe these good things, as I have myself owed many opportunities to Professor Baird; so, reluctant as I was to lay aside my own work when my invitation came, I felt that it was not only a privilege, but a duty, to leave my microscope and my embryos and to come here today to bear witness to my own great debts to him and to remind the younger generation of naturalists how much they owe to him.

As I have not been able to refer to the publications in which the story of his great achievements is recorded, I cannot enter into a specific account of any of his great works, so I must try, as well as I can, to look at them from a more general standpoint.

It is in all modesty that I undertake this task, for the life and works of a great man like Professor Baird teach many lessons to many men, telling each one only that which he is best prepared to hear and to understand. I am well aware that he who ventures to read to others the lesson of such a life may only succeed in laying bare, to some one of deeper penetration, his own inability to grasp its truest and best meaning.

Professor Baird's public life began at a time when the scientific bureaus of the government, which have grown and multiplied with such rapidity in our day, and have become so prominent, and complicated, and important, were in the air, although they had, as yet, hardly begun their existence in tangible form.

There was need for a leader and an organizer; for a man who, while well trained in some branch of science, and thus qualified to distinguish the mere pretender from the true investigator, was also endowed with the breadth of view and the catholicity of interest which fit one for generous admiration for success in other fields, and lead them to do all in his power to promote it.

A man was needed who could inspire the confidence of his colleagues and contemporaries, sympathize with and encourage the young, reconcile the rivalries and jealousies of his fellow-workers; and thus bring it about that as the various scientific bureaus of the government began to be organized and

equipped for their duties, they grew up in a spirit of friendly cooperation and mutual aid.

There was need for a man whose integrity and unselfishness of purpose and earnestness and simplicity of character and clearness and directness of thought and speech and action were so evident and so universally known and esteemed, that he could command a friendly hearing from the seat of government, and gain the intelligent interest and support of Congress for new and expensive plans to extending the scope and increasing the efficiency of our scientific bureaus.

Professor Baird was eminently fitted for this peculiar and difficult field of usefulness. He had many able and eminent allies and fellow-workers, and while he must not have all the credit for the wisdom with which the scientific work of our government was organized and coordinated, it is nevertheless a fact that there are few scientific bureaus which do not still exhibit the impression of his hand, while some of them are his alone.

My own acquaintance with him began in the later years of his life, at the time when he was fully occupied in developing the plans and in laying the foundations upon which such stately edifices have been reared; so I am unable to speak of his younger days; but I cannot believe that he willingly turned aside from his earlier studies of ornithology and general natural history, or that he abandoned these pursuits for the weary and vexatious work of administration without a struggle.

He perceived the needs and the opportunities of his day, and he knew his own ability to make a wise use of these opportunities, and he entered into the work which lay nearest his hand with all the enthusiasm and energy of his kindly and disinterested nature.

The institutions with which the name of Professor Baird is associated, and the works to the encouragement and promotion of which his life was devoted, exhibit a three-fold purpose—to promote the progress of natural knowledge through researches in laboratories and in museums, and through explorations and discoveries, and through the reward of membership in the National Academy of Science; to diffuse and distribute it among men by means of publications and museums and exhibitions; and to advance its application to the material needs of mankind through the protection and regulation and development of the bounty of nature. We are too apt to look at these three aspects of science as three distinct and independent fields, each of which may be successfully cultivated out of all relation to the others. Thoughtful scientific investigators, who ought to know better, are not always free from a feeling of superiority to those who devote themselves to its diffusion or to its practical application; and some, who are less thoughtful, have been heard to speak in disparaging terms of the mere popularizer, and of bread and butter science. Some of them have even been known to boast that the object of their own researches is so far removed from the possibility of practical application that it can never, by any possibility, be put to any conceivable use whatever.

I am not able to say anything about the secret reflections of those who have grown rich through the practical application of scientific discoveries, but I have an impression that their respect for the investigator who, while he may earn his bread, has but a small share of the world's butter, is not very great, and that they do not always look upon him as one whose life has been altogether successful.

No one has ever been more free from every trace of this littleness of mind than Professor Baird. To him the promotion of science, and its diffusion, and its practical application were not three independent ends which could be attained by different means. He was as well aware as Francis Bacon that it is only in the coordination of these three aims, and in the maintenance of a just and equal balance between them, that science finds its true inspiration and its very life. It may be that the naturalist is better prepared than other men of science to perceive this. The practical application of natural history to the material needs of mankind is not, commonly, of the sort for which men pay money. It is like the rain and the sunshine. It is not thought of as enriching any, because it enriches all. It is, no doubt, for this reason, that there is more mutual respect and regard and good fellowship between those who devote themselves to research and those who are occupied with its practical application in this province than there is in other branches of science.

As Professor Baird was a naturalist, he was better fitted than most men of science for diffusing and applying natural knowledge, as well as encouraging it and contributing to its advancement; and all his undertakings bear witness to the soundness of his judgment as to the balance which should be maintained, in a bureau of our government, supported by the people of our country, between these three purposes, and the way in which success in the accomplishment of each of them should be made to contribute to the sound and healthful progress of the others. This is, in my opinion, one of the most instructive lessons of his life and work, and it is nowhere more clearly illustrated than in the organization and operation of the Fish Commission. It is because of the wisdom and foresight with which the Fish Commission has been so organized and conducted as to bring this about that it has come to be looked upon, by foreign governments, as a model to be studied and copied from.

The purpose for which it is maintained by our citizens is the improvement of our fisheries, and it has seemed to some that deep-sea explorations and research in laboratories are no part of its duty to the public, but Professor Baird knew the progress in the expansion and improvement of the economic work would soon come to an end without the aid of the student of pure science, and that the Commission would quickly degenerate into a mere clerical routine and mechanical round of perfunctory duties without the inspiration of scientific discovery.

All men prize the fruit, but he understood that the tree will soon be barren if we visit it only at the harvest; that we must dig about it and water it, and cherish the blossoms and the green leaves, else there will soon be no fruit to be gathered.

But I have no thought of coming before you today as a champion of pure science; nor do the people of America

need to be informed that it is the fountain head from which all the arts that enrich our civilization are supplied. So I ask your leave to devote the rest of my time to the examination of a criticism which has been made of the practical work of the Fish Commission—an objection which, because of its plausibility, and because of the eminence of the authority who has been its most prominent advocate, has had great weight with many of the thoughtful and reflective, and has received the endorsement of many naturalists.

You all know that Huxley believed, and took many public occasions to declare, that marine fishes, like the cod and the mackerel, inhabit the ocean in such innumerable multitudes, and are so prolific, that the utmost efforts of man can have no practical effect upon their numbers, because they are exposed to the ravages of so many natural enemies that the destruction caused by man is not worthy of consideration in comparison. He is, therefore, led to believe that efforts to maintain them in their natural abundance or to add to their numbers by artificial propagation are misdirected and useless. Respect for Huxley's experience and good sense and sound judgment has led many to think that this opinion is sound and well warranted, and when we reflect that innumerable millions of young mackerel and cod are born in a state of nature for each one that can be reared artificially, and that millions are born for each one that lives through the perils of infancy and survives to maturity, there does not seem to be reason for doubting whether the efforts of man to affect the supply of marine fishes by artificial means can have any effect; for man's addition to their numbers is only as a drop of water in the ocean, and the chances of survival of any young fishes that are hatched by human aid and then cast into the ocean to share the perils of those that are born naturally can only be as one in millions.

Yet, with all deference to Huxley, I venture to assert that it is he who has made the mistake, and failed to comprehend the problem of the life of marine food fishes, and not Professor Baird and his successors, and that the burden of error is on his shoulders and not on those of the Fish Commission.

Marine food fishes are enormously prolific, because they are exposed to so many dangers and enemies. Natural selection has, in course of ages, brought about such an adjustment between the natural destruction of the individuals of each species and their birthrate, that the number of mature individuals of the species is about equal to the resources of the natural supply of food, and remains constant on the whole, so long as the natural conditions of their life remain unchanged. But when a new disease, or a new rival, or a new enemy, which has not been provided for and guarded against by natural selection, invades their home and comes to stay, the destructive effect of this new element in their lives soon shows itself, even when its ravages are so slight, as compared with the total number of violent deaths, that it seems to be trivial and unimportant. Man is the most resistless and insatiable of destroyers. The fear of him and the dread of him is upon all the beasts of the field, and upon the birds of the air, and upon all the fishes of the sea, and upon everything that moveth upon earth, but he is not a part of that order of nature to which the birthrate of marine animals has been adjusted. As a navigator and a sea fisherman he is too new to have given natural selection time to have produced any compensating adjustment; and the quickness with which he invents new weapons of destruction, and improves himself in their use, far outstrips the movement of this slow process of modification; for the time he has needed to progress from the bone fishhook and the hurdle of rushes to the steam fishing vessel, is as nothing in the long history of species. It is, no doubt, true that the whole number of mackerel and cod and herring which he destroys is as nothing when we compare it with the slaughter wrought by bluefish and porpoises and dogfish and other sea robbers, but this slaughter is provided for in the birthrate, while that which he works is not. While a number of food fishes, greater beyond all computation than man destroys, has been destroyed by natural enemies each year for ages without any effect upon their abundance, every one knows that when man turns his energy and intelligence and inventive skill to the work of destruction he quickly brings about a very notable decrease in the supply. It is because the slaughter caused by man is infinitesimal that an infinitesimal increase in the birthrate is all that is needed to make it good, and this infinitesimal increase in the birthrate it is, fortunately, within the power of man to bring about by artificial propagation. Instead of showing that efforts to maintain sea fisheries by artificial propagation are misdirected and useless, the well-known facts to which Huxley calls our attention, turns out, when carefully considered and thoroughly understood, to afford the clearest proof of the prudence and wisdom and foresight and scientific knowledge of Spencer Fullerton Baird, the founder of and father of the United States Fish Commission.

President Bowers—We have with us today two members of the American Fisheries Society who are among the early appointees of Professor Baird. Both of them, as known, have made splendid reputations for themselves in connection with the United States Fish Commission. It gives me pleasure to present to this audience Mr. Frank N. Clark, of Northville, Mich., who will address you.

Remarks by
Frank M. Clark

Mr. President and Fellow-Members of the American Fisheries Society, Ladies and Gentlemen: It is with a feeling of the deepest sadness that I undertake to tell you my feelings towards the man whom this memorial tablet represents. It is true that I was connected with Professor Baird in the early stages of the Fish Commission. My association with him was from time to time, and during a period of about fifteen years, when the Fish Commission was not what it is today, when the practical men of the Fish Commission were working in all manners and ways, as you might say, to get the Fish Commission started, and none of those practical men had a warmer friend in all the work than Professor Baird. He was an inspiration to them to

do all they could in helping to establish the Fish Commission. I might tell you all that I feel and all that Professor Baird did for me, but my heart is too full to express it, even had I the ability to do so. Professor Baird was an inspiration in his talk, and many a talk have I had with him on the practical side of fish culture. Discouragements would arrive, and through his talk and through his correspondence new inspiration was given. My friends, not having had time to prepare anything, as I was only spoken to to say a word in regard to this matter, I will now leave you.

President Bowers—The other gentleman I referred to a few minutes ago is Mr. Livingston Stone, of Vermont, who will now say a few words:

Remarks of
Livingston Stone

Mr. President and Members of the Fisheries Society and Ladies and Gentlemen: I do not feel that I can add anything to the very able and interesting addresses which you have already heard, but at the same time I do not feel as if I could decline to say anything on this occasion, for I was one and I am one of the few living early appointees of Professor Baird, when the United States Fish Commission was started. It was my privilege to know Professor Baird from about the time that the Fish Commission started until the time of his death. It was also my privilege to be in somewhat close relations with him up to the time of his death. For it is just thirty-one years ago this month, and almost thirty-one years ago this very day, that I was appointed by Professor Baird to be his deputy commissioner for the Pacific Coast, but if I should attempt to say anything at this time without preparation I should certainly not feel equal to the occasion. However, just before I left home I happened to come across a copy of the Forest and Stream which had something in it which I wrote some time after Professor Baird's death, and although I think it is hardly fair or proper to inflict a printed page upon my hearers today, or upon any occasion, I feel sure that it would be much more satisfactory to you if I should read from this notation of Forest and Stream than if I should try to make any fragmentary remarks without preparation. So, with your kind permission, I will read one or two extracts, but I will not take much of your time:

"The mere mention of Professor Baird's name strikes a chord of dear memories in the hearts of all who knew him. No man of our time has left a purer memory, a more stainless name, or a more animated or enduring influence over his special field of labor than Professor Baird. He was loved by those who knew him when he was living; he is revered by those who have survived him. Professor Baird lived in a higher plane of life and breathed a purer atmosphere than most men. Quiet and unassuming, with a nature as gentle as a child's his natural superiority never failed to show itself when he was with other men, not even among the distinguished men who gathered in the winter at the National Capitol. Yet he was thoughtful and considerate of his subordinates, and always ready to give his meed of praise of any work well done by his humblest employee. Professor Baird had the enviable gift not only of endearing everyone to him who came in contact with him, but of inspiring them with his own enthusiasm and energy. This made Congressmen vote him all the appropriations that he asked for; for it was a common saying at Washington that Congress gave Professor Baird everything that he wanted. Like a good general, he had the personal welfare of his men at heart while he was Fish Commissioner, and they in turn wanted to do everything in their power for him, which, doubtless, was one of the secrets of his great success. It is a fact that his employees in the Fish Commission would voluntarily work a great deal harder for Professor Baird than they would for themselves. This fact is prevalent for another saying at Washington at that time—that Professor Baird's men were the busiest workers in all the departments. It was the inspiration of this patient, disinterested, tireless, kind-hearted and lovable man, whose work they were doing, that made them work so well, and also make their work a pleasure.

"It is unnecessary to say that Professor Baird possessed extraordinary mental endowments, but I perhaps may mention one or two, as they are so rare. He had a quickness of apprehension that sometimes seemed supernatural. For instance, he would glance down a printed page and comprehend in a moment what would take others several minutes to read.

"He had a marvelous memory, not only retentive of everything intrusted to it, but quick to call up anything that was wanted when it was wanted—a quality which most of us know well how to appreciate. His mind was also of the clearest type. No complications ever seemed to confuse him; he never became involved during his conversation, no matter what were the intricacies of the subject. His mind, like his placid temper, never seemed to be ruffled or disturbed. Extraordinary as his mental faculties were, he had evidently added to their efficiency by severe discipline, for he possessed that infallible mark of a well-trained mind, of having all of his great and diversified stores of knowledge classified and grouped together in his brain according to subjects, so that he could call up his whole knowledge of any subject at a moment's notice. Another remarkable thing about Professor Baird's mental composition was that with a thoughtful, scientific cast of mind were united qualities of the most practical character. Professor Baird was a scientific man by nature. He loved science and scientific studies; but at the same time no man had a sounder judgment or a clearer head in the management of practical affairs than he did. It is very rare to see scientific and practical qualities of mind united in such an eminent degree as they were in Professor Baird's.

"Professor Baird was gifted with still another unusual mental endowment, which reminds one strongly of one of the traits of the first Napoleon. With that comprehensiveness of mind which takes in the broad features and large general outlines of a great enterprise, he combined, as Napoleon did, a capacity for close and thorough attention to all the details of a subject down to the minut-

est item necessary to success. This combination, as we all know, is a rare one.

"Professor Baird has been called a plain man. He was a plain man indeed, but one who was made after Nature's largest pattern of men. He was large in mental calibre, and large in physical frame; large in his broad sympathies and in his wide scope of vision; large in his comprehensive grasp of great aims, and large in his capacity for great undertakings; large in everything, but small in nothing."

President Bowers—This closes our exercises, and on behalf of the American Fisheries Society, I want to thank you for your courteous attention and your presence here this afternoon.

Editorial Guidelines for the *Marine Fisheries Review*

The *Marine Fisheries Review* publishes review articles, original research reports, significant progress reports, technical notes, and news articles on fisheries science, engineering, and economics, commercial and recreational fisheries, marine mammal studies, aquaculture, and U.S. and foreign fisheries developments. Emphasis, however, is on in-depth review articles and practical or applied aspects of marine fisheries rather than pure research.

Preferred paper length ranges from 4 to 12 printed pages (about 10-40 manuscript pages), although shorter and longer papers are sometimes accepted. Papers are normally printed within 4-6 months of acceptance. Publication is hastened when manuscripts conform to the following recommended guidelines.

The Manuscript

Submission of a manuscript to *Marine Fisheries Review* implies that the manuscript is the author's own work, has not been submitted for publication elsewhere, and is ready for publication as submitted. Commerce Department personnel should submit papers under a completed NOAA Form 25-700.

Manuscripts must be typed (double-spaced) on high-quality white bond paper and submitted with two duplicate (but not carbon) copies. The complete manuscript normally includes a title page, a short abstract (if needed), text, literature citations, tables, figure legends, footnotes, and the figures. The title page should carry the title and the name, department, institution or other affiliation, and complete address (plus current address if different) of the author(s). Manuscript pages should be numbered and have 1½-inch margins on all sides. Running heads are not used. An "Acknowledgments" section, if needed, may be placed at the end of the text. Use of appendices is discouraged.

Abstract and Headings

Keep titles, heading, subheadings, and the abstract short and clear. Abstracts should be short (one-half page or less) and double-spaced. Paper titles should be no longer than 60 characters; a four- to five-word (40 to 45 characters) title is ideal. Use heads sparingly, if at all. Heads should contain only 2-5 words; do not stack heads of different sizes.

Style

In style, the *Marine Fisheries Review* follows the "U.S. Government Printing Office Style Manual." Fish names follow the American Fisheries Society's Special Publication No. 12, "A List of Common and Scientific Names of Fishes from the United States and Canada," fourth edition, 1980. The "Merriam-Webster Third New International Dictionary" is used as the authority for correct spelling and word division. Only journal titles and scientific names (genera and species) should be italicized (underscored). Dates should be written as 3 November 1976. In text, literature is cited as Lynn and Reid (1968) or as (Lynn and Reid, 1968). Common abbreviations and symbols such as mm, m, g, ml, mg, and °C (without periods) may be used with numerals. Measurements are preferred in metric units; other equivalent units (i.e., fathoms, °F) may also be listed in parentheses.

Tables and Footnotes

Tables and footnotes should be typed separately and double-spaced. Tables should be numbered and referenced in text. Table headings and format should be consistent; do not use vertical rules.

Literature Cited

Title the list of references "Literature Cited" and include only published works or those actually in press. Citations must contain the complete title of the work, inclusive pagination, full journal title, and the year, month, volume, and issue numbers of the publication. Unpublished reports or manuscripts and personal communications must be footnoted. Include the title, author, pagination of the manuscript or report, and the address where it is on file. For personal communications, list the name, affiliation, and address of the communicator.

Citations should be double-spaced and listed alphabetically by the senior author's surname and initials. Co-authors should be listed by initials and surname. Where two or more citations have the same author(s), list them chronologically; where both author and year match on two or more, use lowercase alphabet to distinguish them (1969a, 1969b, 1969c, etc.).

Authors must double-check all literature cited; they alone are responsible for its accuracy.

Figures

All figures should be clearly identified with the author's name and figure number, if used. Figure legends should be brief and a copy may be taped to the back of the figure. Figures may or may not be numbered. Do not write on the back of photographs. Photographs should be black and white, 8 × 10 inches, sharply focused glossies of strong contrast. Potential cover photos are welcome, but their return cannot be guaranteed. Magnification listed for photomicrographs must match the figure submitted (a scale bar may be preferred).

Line art should be drawn with black India ink on white paper. Design, symbols, and lettering should be neat, legible, and simple. Avoid freehand lettering and heavy lettering and shading that could fill in when the figure is reduced. Consider column and page sizes when designing figures.

Finally

First-rate, professional papers are neat, accurate, and complete. Authors should proofread the manuscript for typographical errors and double-check its contents and appearance before submission. Mail the manuscript flat, first-class mail, to: Editor, *Marine Fisheries Review*, Scientific Publications Office, National Marine Fisheries Service, NOAA, 7600 Sand Point Way N.E., Bin C15700, Seattle, WA 98115.

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